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**NOTE**

Instead of raising the price of membership, and in order to meet the requirements of the War Industries Board, and also because of the drafting of the whole Editorial Staff the July, August and September numbers have been dropped out for 1918. Vol. IX contains only 8 instead of 12 numbers.


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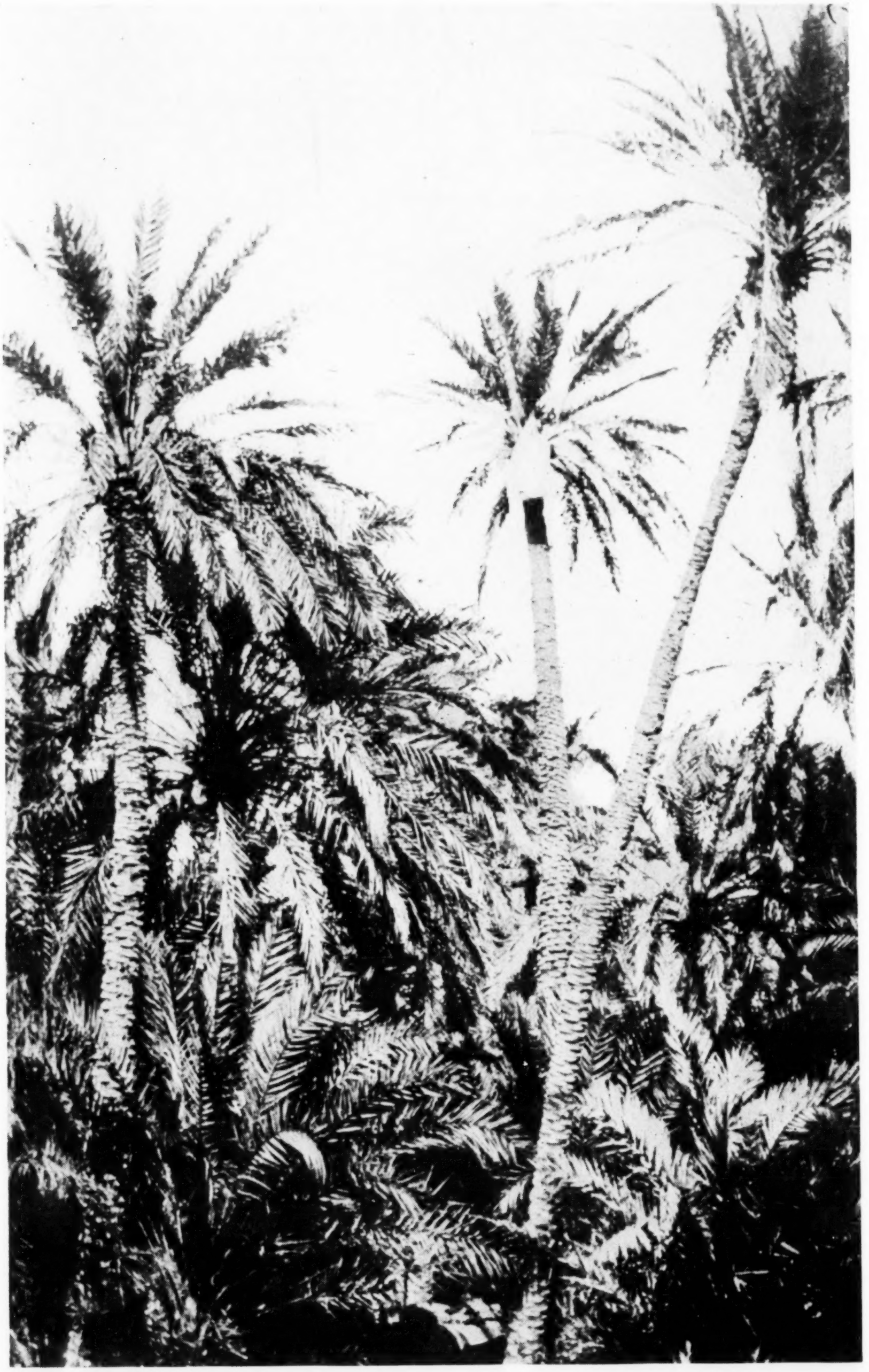

**FOREST OF OLD DATE PALMS IN THE SAHARA**

The photograph illustrates what was perhaps the first home of the breeders of plants, from four to six thousand years before our era. (From Bull. 53, Bur. of Plant Industry, U. S. Dept. of Agriculture.) (Frontispiece.)

# THE FOUNDERS OF THE ART OF BREEDING

HERBERT F. ROBERTS
*Kansas State Agricultural College*

## FIRST HOME OF BREEDERS OF PLANTS

EXACTLY where or when men first began to practice agriculture, and to bring into cultivation and domestication the plants and animals they found about them, no one can tell. It is certain, however, that one of the earliest homes of civilized man upon earth was in the lower basin of the Tigris and Euphrates rivers in southwestern Asia, the site of the biblical "Garden of Eden," known locally today by the Arabic name of "Iraq."

From four to six thousand years before our era, and at least fifteen hundred years before the days of the Jewish patriarch Abraham, this region was occupied by an already ancient, orderly and settled civilization, possessing cultivated plants and domestic animals. Indeed, there is little reason to doubt that the low alluvial plain fed by the "waters of Babylon" was the scene of one of the very first of man's attempts at the improvement of plants, for it is known that, at the earliest time recorded in human history, the cultivation of the date palm was being carried on in this region.

## DATE CULTURE IN ANCIENT BABYLONIA AND ASSYRIA

The history of the date palm typifies, better than that of almost any other plant, man's relation to the plant world as a moulder of its cultivated forms. The great extent of the culture of dates in Mesopotamia in ancient times, is made very plain to us from the many Babylonian and Assyrian inscriptions. The monuments of these ancient empires show not only the methods of culture and the serving of the date as food, but even the process of hand pollination (10).

From the ruins of Nineveh there comes, for example, an inscribed monument of Ashurbanipal, who lived about 650 B. C., king of Assyria at the zenith of its power, the Sardanapalus of the Greeks, and the "Grand Monarque" of the ancient world.

In this bas-relief he is represented upon a couch in his garden. Over his head stretch the loaded garlands of the grape vine, while to the rear stands a date palm laden with fruit.

The tremendous economic value of this remarkable tree, even in those early times, is attested by a Babylonian hymn, quoted by both Pliny and Strabo, which recites three hundred and sixty uses for the plant. As late as the thirteenth century, the celebrated traveler, Marco Polo, speaks of "a great city called Bastra (modern Busreh) surrounded by woods, in which grow the best dates in the world."

## WHY MEN LEARNED PLANT BREEDING FROM THE DATE PALM

It had probably always been recognized, since animals were first extensively domesticated, that the fact of sex lay at the basis of whatever improvement in their characters man could bring about, for the reason that, in animals, "breeding" has always meant the use of superior animals (usually superior males) in crossing. In plants, however, the existence of sex is less evident than in the case of animals, partly because of the fact that in most plants the sexes are not separated. But in the date palm, we have at once a plant of supreme economic value in certain regions, and one in which the sexes exist separately as in all the higher animals. Indeed it came to be recognized, from the earliest times, that date trees were of two kinds, sterile and

**THE BREEDING OF DATE PALMS**

Cluster of female flowers being tied together to hold the sprig of male flowers in place. It has been recognized from earliest times that date trees were of two kinds, sterile and fruit-bearing, and that the product of the sterile trees was needed to insure the bearing of fruit. (From Bull. 53, Bur. of Plant Industry. Loaned by the U. S. Dept. of Agriculture.) (Fig. 1.)

fruit-bearing, and that the product of the sterile (male) trees was needed in order to insure the bearing of fruit by the other (female) trees.

Kazwini (5), the Arabic writer on natural history, says of the date, "It is created out of the same substances as Adam, and is the only tree that is artificially fertilized." The seeds of the date produce about half and half, male and female trees. The female trees are wind pollinated, and there would, therefore, easily be enough male trees to fertilize them under natural wild conditions. However, under cultivation, the growing of such a large proportion of non-fruit-bearing or male trees, would be a very wasteful use of the land, and we find that as early as Babylonian and Assyrian times it was discovered that the pollen from a small number of male trees could be made to suffice for fertilizing a considerable number of female trees, by substituting hand pollination for the natural method. At the present time, according to Swingle (10) the proportion used in planting is about one male to one hundred female trees.

### VARIATION AND SELECTION OF DATE PALM

It was soon learned that, when the seeds from the fruits thus obtained by fertilization were planted, the offspring could no more be depended upon to bear fruits like those of the mother tree than can the seedlings of our modern "budded" peaches, apples, or pears. As a matter of fact, the seedlings coming from any given variety of date show a very wide range of variation, and it is said that the original parent type seldom reappears among the seedlings (10).

This diversity of type among seedling dates has led to the establishment of a great number of varieties in cultivation. From four cases of the Sahara alone, over four hundred distinct varieties of date palms are reported, which vary greatly in the size, shape and flavor of the fruits, some being round, some oval, others slender and elongated. In color the fruits vary from light brown to deep black. Some varieties ripen dry, and furnish a staple food product useful for long journeys. Others are so soft and syrupy that they must be eaten fresh.

Thus we see that, through the medium of the date palm, man, in one of his earliest homes, learned two great facts upon which all plant improvement rests—the fact of variation, which makes selection possible, and the fact of plant sex, upon which "plant breeding" in the true sense is based.

### DISCOVERY OF SEX IN PLANTS THE LESSON THAT WAS LOST

We have seen that the Babylonians understand that the date palms were of two sorts, male and female by nature, and that they utilized this knowledge in a practical way by resorting to artificial pollination of the female trees in order to make them bear more abundantly. We also know that the Arabs have continued this practice uninterruptedly to the present time. Indeed they seem to have had a distinct understanding that the date palm possessed sex in the same sense in which it exists in the animal kingdom. Kazwini, who died about 682 A. D., and to whom reference has already been made, says plainly in his book: "Of the marvels of Nature, and of the Singularities of Creating Things," the date has a striking resemblance to man, through the beauty of its erect and slender figure, its division into two distinct sexes, and the property, which is peculiar to it, of being fecundated by a sort of union."

However, the lesson which the date palm might have taught men—that all plants possess sex, and hence that breeding can be conducted with them as with animals—appears to have been lost. Even in those regions where the date was grown, the idea which the long-continued practice of artificial pollination ought to have suggested—that it was possible to breed and improve other plants in like manner—seems never to have arisen. One would naturally suppose that the ancient Babylonians, having learned the art of artificial crossing in the case of one plant, would have applied the same process to others.

**THE POLLINATION OF THE DATE PALM**

In the date palm the sexes exist separately as in all the higher animals. Arabs inserting a sprig of male flowers. (From Bull. 53, Bur. of Plant Industry, U. S. Dept. of Agriculture.) (Fig. 2.)

**R. J. CAMERARIUS**

In 1694, Camerarius wrote an extraordinary "letter" to his friend Professor Valentin. This letter fills some fifty printed pages, is entitled "*De Sexu Plantarum Epistola.*" (Fig. 3.)

The reason for their failure to do so is, however, in a measure explainable. No other important plants with which they came into contact in their fields exhibited a similar striking division into two distinct sexes. For example, they did not chance to possess at the same time a plant like Indian corn, in which the sexes are at least partially separated, in which pollination is a conspicuous fact, and in which crossing not only can be seen to be continually taking place in nature but can likewise easily be carried out by artificial methods. Otherwise it is possible that a further advance would have been made in plant breeding, even in those early times. As a matter of fact, no second lesson was learned. The book was closed, and the land of Babylonia, where the first plant breeders lived, became the desert which it remains to this day. Literally, in the words of the Prophet Jeremiah, "Her cities are a desolation, a dry land and a wilderness."

### BEGINNING OF THE NEW LESSON

Ages of oblivion had rolled over the land where nature taught men their first lesson in plant breeding. Nearly all that we commonly call the history of the world had taken place. On the 25th of August, 1694, in his laboratory in the University Tübingen, in South Germany, Rudolph Jacob Camerer, Professor of Natural Philosophy, better known to science under his latinized name of Camerarius, finished the writing of an extremely long letter to his friend, Professor Michael Bernhard Valentin, of the University of Giessen. This extraordinary "letter," which fills some fifty printed pages, is entitled *"De Sexu Plantarum Epistola."*[1] It recounts at length, not only the knowledge, slender enough though it was on this subject, which existed up to his time, but gives a full description of Camerarius' now extensive experimental work.

It is almost incredible, but it is a fact, that this constitutes the first piece of acual scientific investigation into the quesion of the existence of sex in plants that had ever been made, since the date palm had thrown out its first plain and single suggestion more than seven thousand years before.

The Greek and Roman writers on natural history, Aristotle (1), Pliny (8), and Theophrastus (11), had commented on the supposed nature of sex in plants; Theophrastus, and especially Pliny, even citing plainly and definitely the case of the date palm; but it is evident, from the vague and contradictory nature of their views, that they carried on no experiments to determine the facts. This was exactly, however, what Camerarius did.

He was the first botanist to discover by actual experiment that the pollen is indispensable to the fertilization of the seeds, and that the pollen-producing flowers or plants are therefore male, and the seed-bearing ones female, in nature. Camerarius conducted his experiments with spinach, hemp, and hops, in which the pollen and seed-bearing plants are distinct, and with Indian corn, or maize. He was likewise the first botanist to discover, two hundred years after maize had been introduced into Europe from America, what seems to us a simple and every-day fact, that on removing the pollen-bearing flowers from the tassel of an isolated corn plant the seeds on the ears remained unfertilized.

### PREPARING WAY FOR BREEDERS

The outcome of his experiments, together with the results obtained with the other plants mentioned, enabled Camerarius (2) to come to this conclusion regarding sex in plants (p. 28):

"They behave indeed to each other as male and female, and are otherwise not different from one another. They are thus distinguished with respect to sex, and this is not to be understood, as is ordinarily done, as a sort of comparison, analogy, or figure of speech, but is to be taken actually and literally as such."

We have thus reached another definite landmark in plant breeding. First, the date palm suggested the idea that

[1]Letter concerning the sex of plants.

IOANN. GEORG. GMELIN
MED. D.

SERMO ACADEMICVS
DE
NOVORVM
VEGETABILIVM
POST CREATIONEM DIVINAM
EXORTV

D. XXII. AVG. cIↃIↃCCCXLIX.
PVBLICE RECITATVS

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ADDVNTVR
PROGRAMMA AD PANEGYRIN
HANC INVITANS
ET PROPTER MATERIÆ NEXVM
D. RVD. IAC. CAMERARII
PROF. OLIM TVBING. LONGE CELEB.
AD D. MICH. BERN. VALENTINI
PROF. GIESS.
DE
SEXV PLANTARVM
EPISTOLA.

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TVBINGÆ LITERIS ERHARDTIANIS.

**CAMERARIUS' TITLE PAGE**

Introductory page to Camerarius' published letter upon sex in plants, written in 1694. (Fig. 4.)

plants possess sex as do animals, but not a single experiment is recorded until Camerarius, attacking the problem in the modern way, by means of an experimental garden and a microscope, found that sex actually exists in plants as it exists in animals. The knowledge of this fact opened the way for the work of experimental plant breeding. As we have seen, "plant breeding," strictly so-called, means the production of new types of plants as the result of crossing. Therefore, the science of breeding involves a knowledge of, first, the fact of sex, and second, of the behavior of hybrids. Thus the barrier to progress in plant breeding was removed by Camerarius' discovery of sex in plants.

Nor did his searching mind fail to sense the great possibilities latent in the field of hybridization which were involved in this discovery, for he says in passing (p. 49):

"The difficult question, which is also a new one, is whether a female plant can be fertilized by a male of another kind, the female hemp by the male hops; the castor bean from which one has removed the staminate flowers, through pollination with the pollen of Turkish wheat (maize); and whether, and in what degree altered, a seedling will arise therefrom."

In this striking sentence we find outlined, although in fantastic guise, the germinal conception which underlies all plant breeding, viz., the creation, through crossing, of new and hitherto unknown types. In this brief paragraph we glimpse the fresh spirit of a new era of scientific investigation.

Camerarius, however, seems never himself to have attempted the artificial crossing of plants, and it was a full hundred years before his discovery regarding sex in plants received any recognition whatsoever, and before we find the first recorded instance of an actual experiment in hybridization.

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# BETTER AMERICAN FAMILIES III

## Showing How the Level of a Trait or Trait-Complex May Be Raised Through Marriage-Selection

WILHELMINE E. KEY

*Eugenics Record Office, Carnegie Institution of Washington, Cold Spring Harbor, Long Island, N. Y.*

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IN tracing the history of the Rufer family as given in the preceding paper, the conclusion seems justified that through selective matings, the grade of such traits as aggressiveness, perseverance and the ability to handle number was noticeably increased or diminished. For example, in Line E the absence of such abilities with the concomitant failure of the individuals to marry those possessing the abilities in question persisted through five generations. In Line C a comparatively low ability to calculate has, through selective matings with good or average ability, been built up into ability which is average or in some instances even above the average. This holds true also of the trait-complex aggressiveness. In Line D again, ability with number, and aggressiveness have through matings with a low grade of these abilities, persisted at the low level of the original founders. In the same way the trait-complex perseverance is found to move up or down in fair accord with the type of mating made.

Let us now see how far the behavior of these abilities in inheritance conforms to the Mendelian hypothesis. At the outset, we concede that our data, since they appertain to mental and temperamental traits, do not permit of the accuracy of measurement possible in handling physical traits. It will, however, be generally agreed that all have a basis in heredity and remain far less affected by environmental influences than many other characters that might be selected for study. And with at least one ability, that of dealing with number, it is possible to adhere to uniform objective standards. Our justification for attempting to carry the Mendelian principles into this domain is the value which even approximate conclusions may have for future effort along similar lines.

### THE ABILITY TO CALCULATE

If we let C stand for comparative presence of determiners for this ability, and c for their comparative absence, whether they occur in a unit-like series of similar or various elements, we have the following possible combinations in the union of germ plasms: CC developing relatively high ability which we may indicate by H; Cc developing mediocre ability indicated by M; and cc developing low ability indicated by L.

Distribution of these abilities from different types of mating would be as follows:

cc x cc —100% cc., *i. e.*, All children show very low ability.
Cc x cc —50% Cc and 50% cc. Half the children show medium ability, half low ability.
Cc x Cc —25% CC, 50% Cc and 25% cc. One-fourth the children with high, half with medium and one-fourth with low ability.
cc x CC—100% Cc. All children show medium ability.
Cc x CC—50% Cc and 50% CC. Half show medium ability and half high.
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In the studies of distribution as actually occurring in the Rufer family, the germinal constitution was necessarily inferred from the character of the individual. That is, low ability was taken to indicate the germinal constitution cc, or all germ cells with relative absence of determiners for calculating ability. Cc medium ability, with half the germ cells having determiners and half not having sufficient determiners for this ability; while high ability indicates the germinal constitution CC, or all germ cells with sufficient determiners for this ability.

Let us examine first the distribution of the grades of this ability in a group of the Rufer family where the level of the ability is distinctly lower than that of the general population. Here class I, indicated by L, includes all those having no ability to handle quantities beyond 5; class 2, indicated by M, includes all those able to perform simple multiplication and division, and make small change; class 3, indicated by H, includes all those having ability beyond this, but still not above the average for the general population. The progeny of 48 matings, including 177 offspring were graded and their distribution in the three classes compared with the theoretical expectation as given above.

Comparison of percentages realized with percentages expected:

| | L x L | L x M | L x H | L x L | x M | M H | L x L | M | H |
|---|---|---|---|---|---|---|---|---|---|
| Expected.. | 100 | | | 50 | 50 | | | 100 | H |
| Realized... | 100 | | | $52^9$ | $33^3$ | $13^8$ | 30 | 60 | 10 |
| | M x L | M x M | M x H | L | x M | H H | L x L | M | H |
| Expected.. | 25 | 50 | 25 | | 50 | 50 | | | 100 |
| Realized .. | $18^5$ | $70^4$ | $11^1$ | $13^1$ | $39^1$ | $47^8$ | | $2^4$ | $97^6$ |

The realized percentages support the following conclusions: (1) When both parents show a low grade of this ability, all the children are similarly of low grade. (2) When both parents show high ability, practically all the children are similarly endowed. (3) When one parent shows a low grade and the other a medium or high grade the increase in the percentage of medium and high is proportionate to the grade of the abler parent. Although a small proportion of low grades are produced by the mating of a medium with a medium of high grade, here again the proportion of low grades shows greater decrease when one consort is of high grade than when he is of medium grade.

A similar study of the distribution of grades of calculating ability was made in the Riel group. The distribution of thirty-two families including 120 individuals was determined, only here, different values were assigned to the three classes. L included all those who could perform simple multiplications and divisions and make small change; M included all those with average ability, while H included all those with ability above the average. The comparison of percentages realized with percentages expected follows:

| | L x L | L x M | L x H | L x M | x H | M L | L x M | H | H |
|---|---|---|---|---|---|---|---|---|---|
| Expected.. | 100 | | | 50 | 50 | | | 100 | |
| Realized... | $86^6$ | $13^4$ | | $47^6$ | $52^4$ | | | 70 | 30 |
| | M x L | M x M | M x H | M L | x M | H H | L x L | M | H |
| Expected.. | 25 | 50 | 25 | | 50 | 50 | | | 100 |
| Realized .. | $38^6$ | $42^8$ | $28^6$ | 57 | $38^8$ | $55^5$ | | | |

The realized percentages in this group support all the conclusions drawn from study of the Rufer group, with the exception of the second conclusion, the mating of high ability with high not having occurred.

If we adopt the hypothesis of a unit-like series of determiners in the germ plasm to account for the development of this ability, we may conceive the number which means presence in a low degree in the poor strains, to be replaced by a larger number of determiners and consequent good ability in the better strains. Should this replacement, through "good matings" occur for a number of generations, a point may be reached where fair and good ability would still appear in the offspring, even though there be mating with low ability. That is, relative absence in the germ plasm of the better consort would behave as relative presence to the lack in the weaker consort; the resulting simplex individual would show and transmit fair ability. The serious danger would arise from matings in two consecutive generations with low or no ability. In such cases there would be

reversal of the process and the production of an increasing proportion of children with low ability. We would appear to have here then, segregation, a real alternative inheritance, with possibly units of progressively higher potency as we pass from strains having a low level of this ability to those with superior endowment.

### AGGRESSIVENESS

This trait-complex may be defined as energy and courage in the undertaking of new projects. It will be seen at once that the grades of this character cannot be fixed with the definiteness possible when dealing with number. They were evaluated with reference to the economic and social opportunity, physical and mental limitations and the effect of example on suggestible individuals. The distribution of 282 individuals, the product of eighty matings was as follows:

| | L L | x | L M | L L | x | M H | L L | x | H H |
|---|---|---|---|---|---|---|---|---|---|
| Expected.. | 100 | | | 50 | 50 | | | 100 | |
| Realized... | $88^{8}$ | | $11^{2}$ | $51^{6}$ | 46 | $2^{4}$ | $30^{3}$ | $60^{6}$ | $9^{1}$ |

| | M L | x | M H | M L | x | H H | H L | x | H H |
|---|---|---|---|---|---|---|---|---|---|
| Expected.. | 25 | 50 | 25 | | 50 | 50 | | | 100 |
| Realized .. | $17^{6}$ | $75^{9}$ | $6^{5}$ | $3^{2}$ | $47^{4}$ | $49^{4}$ | | 25 | 75 |

Here again the realized percentages would indicate the heritability of this trait-complex in accordance with the theory of segregation of determiners for the trait-complex. The slightly wider discrepancy between the expected and the realized results is no doubt due to the difficulty of evaluating the character. It will be observed that the discrepancy is considerable only where both parents are moderately aggressive, or where one has a very low grade while the other has a high grade of the trait. In both cases, the offspring show greater resemblance to the parents than the hypothesis would lead us to expect.

### PERSEVERANCE

In dealing with this trait-complex, we are again confronted by the difficulties involved in its evaluation. As in the case of aggressiveness, the social inheritance plays a far greater role in its manifestation than it does in the ability to handle numbers. The persistence with which one follows a line of activity is due mainly to his capacity for forming habits in conjunction with his dominating interests. While the latter have no doubt heritable elements in what are usually known as "aptitudes," still they are affected by all sorts of extraneous influences. Such native qualities as pride, endurance, independence, obstinacy also have their role in its manifestation. When, however, it is remembered that small children show a wide range in this characteristic while imbeciles, who are incapable of conceiving a chain of related purposes, likewise show a wide range, this trait-complex may well be regarded as having heritable elements whose behavior may be profitably investigated.

The children from eighty matings to the number of 269 were classified into three groups, and the results compared with the theoretical expectation according to Mendel's Law.

| | L L | x | L M | L L | x | M H | L L | x | H H |
|---|---|---|---|---|---|---|---|---|---|
| Expected . | 100 | | | 50 | 50 | | | 100 | |
| Realized.. | $96^{8}$ | $3^{2}$ | | $55^{7}$ | $44^{3}$ | | $13^{8}$ | $65^{5}$ | $20^{7}$ |

| | M L | x | M H | M L | x | H H | H L | x | H HW |
|---|---|---|---|---|---|---|---|---|---|
| Expected . | 25 | 50 | 25 | | 50 | 50 | | | 100 |
| Realized.. | $12^{8}$ | 82 | $5^{2}$ | $5^{5}$ | $60^{8}$ | $33^{7}$ | | | 100 |

Here again, there is some discrepancy between the actual and the theoretical results which may well be laid to difficulties in grading and the effect of exogenous elements on the manifestation of innate tendency. Making due allowance for these factors, the conclusion seems warranted that there are heritable elements in perseverance whose behavior is in accord with the principle of segregation.

### CONSTRUCTIVE ASPECT OF SEGREGATION

Our histories furnish many interesting examples where there appears to have been an effective building up of trait combinations through fortunate matings in successive generations. Thus in line A, aggressiveness, perseverance, calculating ability and finally mechanical ability all converge from strains possessing these abilities to produce in the sixth generation unusual mechanical and mathematical aptitude, which with the

foregoing traits is bringing a high degree of success. Another significant series of combinations occurs in line C whereby defects concentrate in a single member of the third generation, who dies without issue, while the combination of medium or high aggressiveness and perseverance with calculating and other mental abilities produces average efficiency of various types in the later generations.

The recent extension of physical and mental tests in determining types of efficiency in the National Army, gives promise of far more accurate ratings in future studies of this kind. By such means this principle of segregation should be found capable of extension in directions at present unthought of. Such extension would provide a means of more accurate prediction as to the outcome of given matings and the trend of development in particular strains. Such extension would prove highly valuable for constructive eugenics.

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## The Immigration of Orientals

Cambridge, Mass., Mar. 8, 1918.

*The Editor of the* JOURNAL OF HEREDITY.

SIR: I should like to make one comment on the subject of Dr. Sidney L. Gulick's League for Constructive Immigration Legislation, which is referred to on page 379 of the December number of the JOURNAL. On paper, the principles of this new league read extremely well, and appeal to many persons who are seriously concerned regarding the probable future volume of immigration to this country. It should be pointed out, however, that it is an essential part of Dr. Gulick's program to repeal our present Chinese Exclusion Act; to end our present "Gentleman's Agreement" with Japan, and to have only one general immigration law. In other words, the plan is to treat all aliens alike, admitting Chinese and Japanese on the same terms as all other nationalities. While the number of Orientals to be admitted would necessarily be very small, for a time, under the proposed limitation to a certain percentage, these numbers would soon automatically increase. Furthermore, the percentages to be admitted could easily be raised. The Gulick plan also involves the naturalization of the Oriental.

It is these portions of the league's program which are strongly opposed by many persons who thoroughly believe in the restriction of immigration; and those who are interested in eugenics, and in the future character of the American race, may well bear these facts in mind. The Gulick plan proposes to put the thin edge of a wedge under the door which our national policy has built against Oriental immigration. It is a very thin wedge now, but it is a wedge.

R. DE C. WARD.

# MUTATIONS IN THE JIMSON WEED

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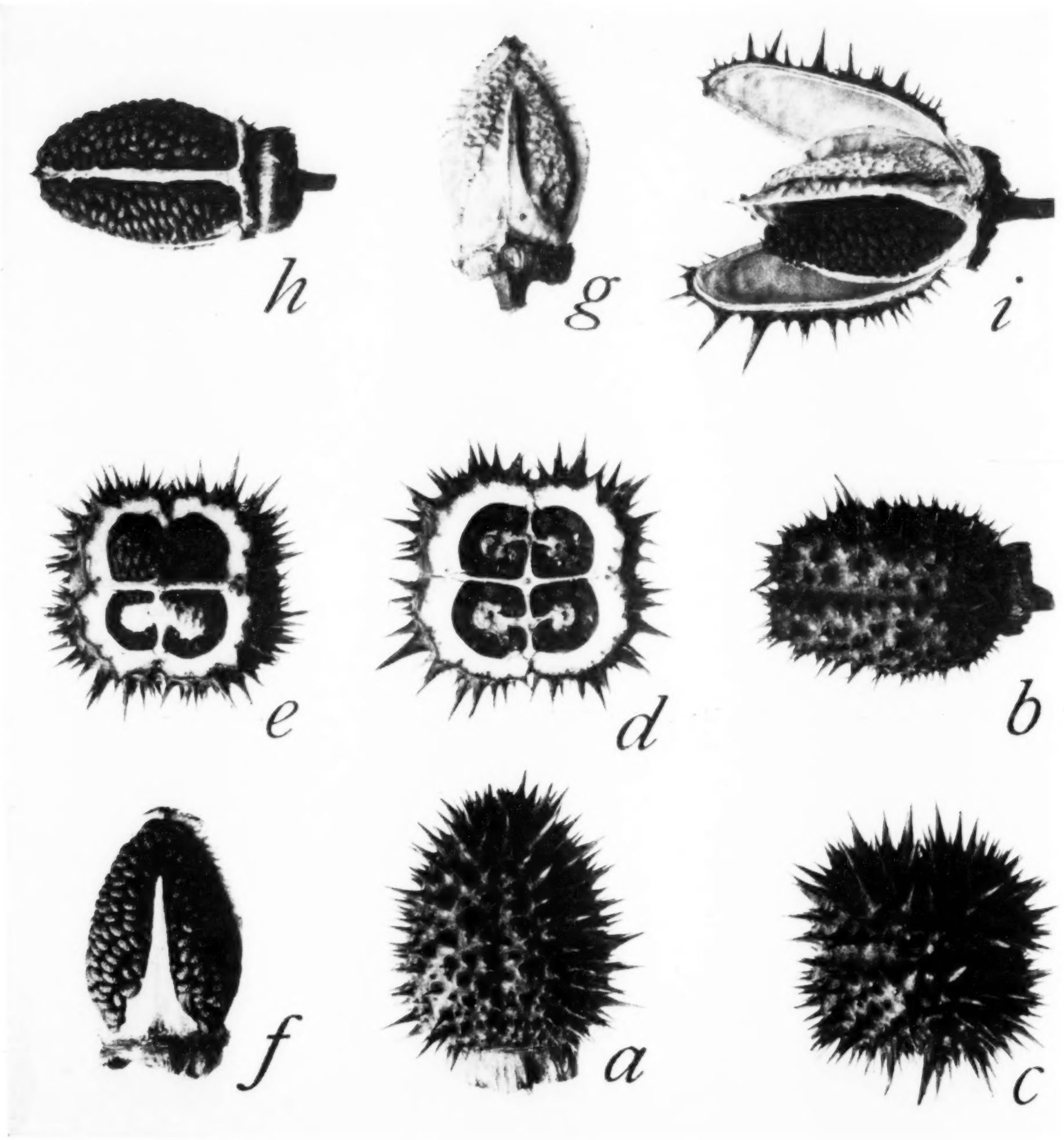
*Station for Experimental Evolution, Cold Spring Harbor, Long Island, N. Y.*

IN a recent article in the JOURNAL OF HEREDITY (March, 1917) the writers pointed out the availability of the common Jimson Weed (*Datura stramonium*) as an illustration of Mendelian phenomena. Data, in addition to those already published by Bateson and others, were reported showing the regularity with which the factors for purple and green stems and for spiney and smooth capsules followed the laws of segregation. The writers have recently determined the presence of another pair of factors affecting the node number and habit of the plant as is shown by the two specimens in Fig. 13. Aside from these three pairs of factors just mentioned and a possible fourth which is under investigation, no other Mendelizing factors, so far as we are aware, have been definitely determined for the Jimson Weed. During the past few years, however, we have discovered in our cultures a number of mutative variants of greater or less distinctness which, so far as studied, seem to be inherited in a manner different from that shown by simple Mendelian characters. We do not wish in this article to go into a detailed discussion of the method of their inheritance. Suffice it to say that these mutations are of sudden, though rather rare occurrence and transmit their characters—chiefly through the female sex—to only a part of their offspring. We desire here merely to present a few of the more marked types in order to give some idea of the extent of departure which they show from the normal. The mutations are distinguished from the normal plants from which they arise, not merely by single visible differences, but by a complex of characters which seem to be inherited as a whole wehn transmitted to their offspring. Leaf and capsule characters are perhaps the most conspicuously affected, although the growth habits and flowers are also involved in the mutations. The flowers, however, fail to show the marked range in color and morphological variation exhibited in many species. The mutations in Datura are distinguished by the same kind of differences apparently that characterize mutations in the classical genus Oenothera.

The capsule is perhaps the best part of the plant to serve as a single example of a given mutation. Its outline differs as seen from different sides. Fig. 5 is a photograph of capsules from a single normal plant arranged to show the internal structure and the resulting outlines in two positions. All the fruits are correctly oriented in relation to the central cross section. While in this section (d), cut midway between the base and the apex, two cross-walls apparently divide the ovary into four cells; the section at the left (e), cut higher up, shows that only a single septum extends completely to the apex. The capsule is in fact, therefore, two-celled with the placenta forming a false partition running part way to the top. The outline of the surface in consequence appears ovate on the placental side (a) and more nearly cylindrical or elliptical on the septum side (b). Typical examples are shown in Fig. 6 from two normal plants and from a number of mutations. At the top are two normals showing the spiney and spineless condition already explained as forming a

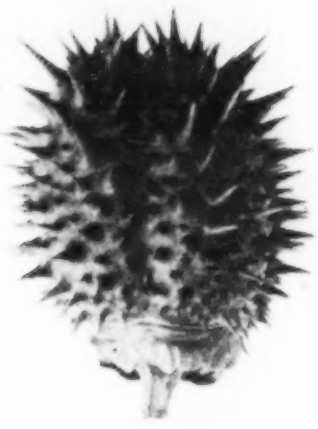
[1] Died in France, June 18, 1918, while in service in the Medical Detachment, 30th Infantry. Mr. Avery, while scientific assistant to the senior author, personally handled all the mutants discussed in this paper. It is largely due to the keenness of his powers of observation that they were discovered. He is also responsible for finding the first "Globe" mutant which started the investigation of variability in the Daturas.




**CAPSULES FROM A NORMAL JIMSON WEED**

These capsules are from a single normal plant and are arranged to show the internal structure and resulting outlines when seen from two different positions. Capsules of Jimson Weed correctly oriented in reference to central section. (*a*) Placental side showing ovate outline; (*b*) septum side showing elliptical outline; (*c*) top view; (*d*) cross section through middle; (*e*) cross section near apex leaving seeds intact on one side of septum and removed on other, exposing placenta; (*f*) placental side, outer walls removed, seeds intact; (*g*) the same, seeds also removed; (*h*) like (*f*) but septum side; (*i*) the same but seeds removed from one side and half of outer wall left intact. (Fig. 5.)

simple Mendelian pair in inheritance. The mutations on the three lower rows in Fig. 6 have been given provisional names taken chiefly from capsule or leaf peculiarities. Reading from left to right, we have on the second row from the top: "Sugarloaf" with characteristically shaped capsules and stunted spines: "New Species" with spherical capsules; "Globe" with globose, depressed capsules and stout spines; and "Glossy" with small shiny capsules. On the



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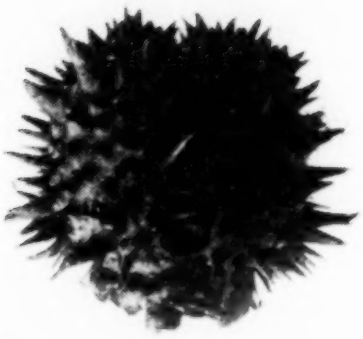

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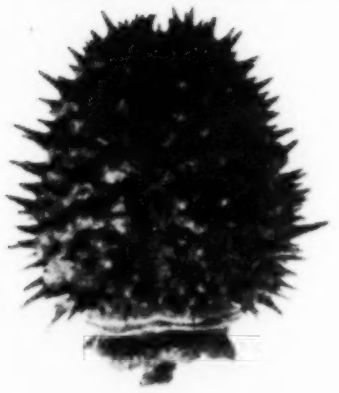

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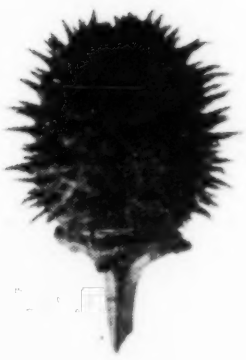

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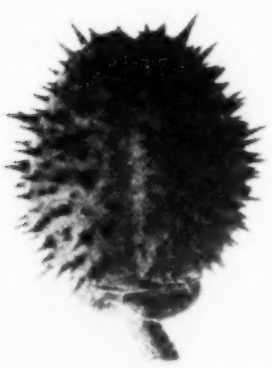

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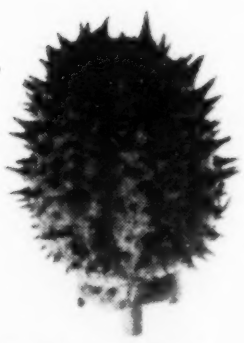

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**CAPSULES OF VARIOUS FORM**

At the top are two normal capsules showing the spiney and spineless conditions which form a simple Mendelian pair in inheritance. The mutations in the three lower rows have been given provisional names taken chiefly from capsule or leaf. (Fig. 6.)

**NORMAL JIMSON WEED**

Pot-grown normal plant shown for comparison with other plants. (Fig. 7.)

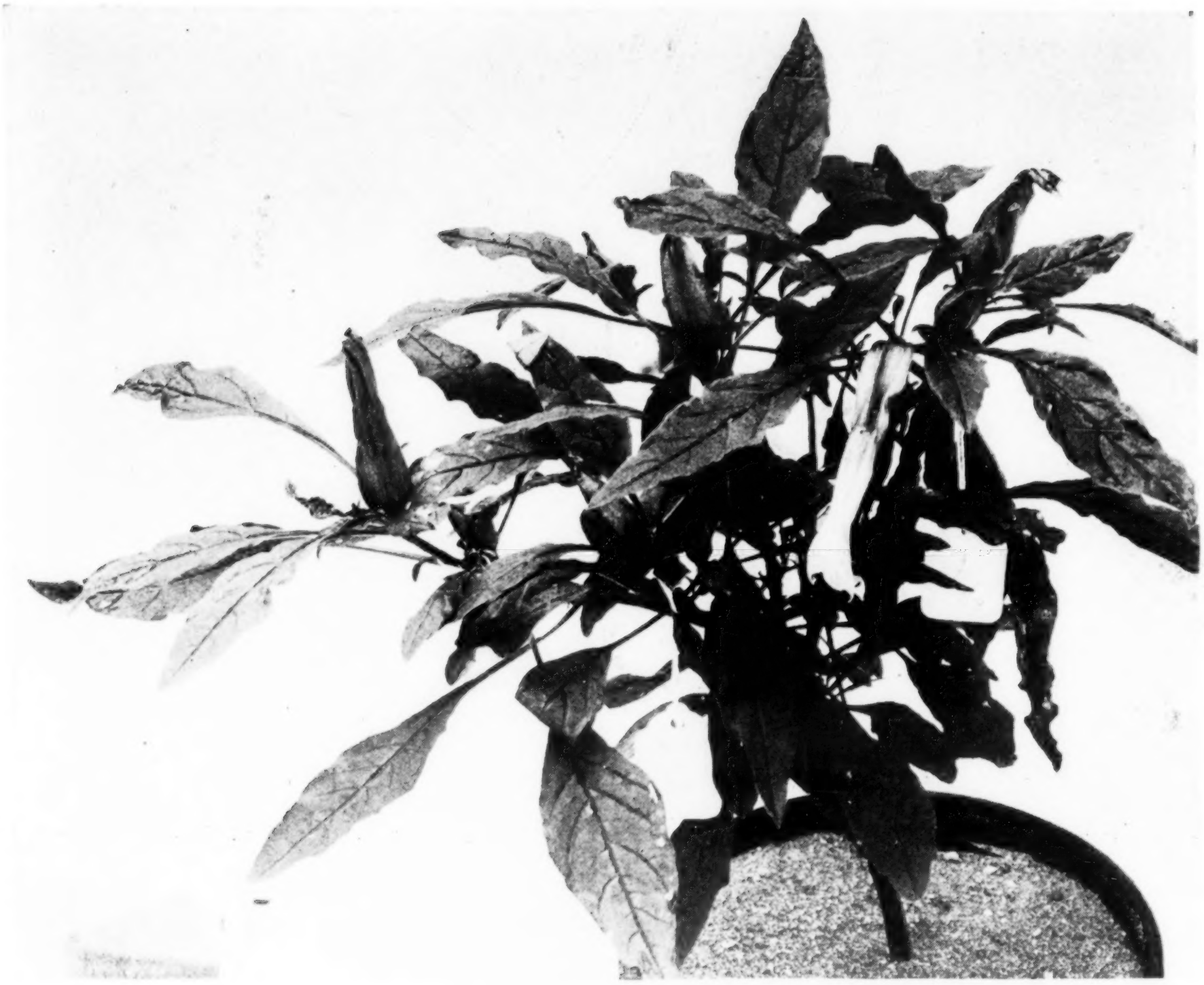
third line: "Cockelbur" with small nartow capsules; "Mutilated," two capsules, the one on left showing the usual mutilated condition of apex suggesting the name; and "Ilex" with small capsules and slender spines. On the fourth line "Tobacco-leaf" with small capsules and short stout spines; "Microcarpic" with small, rather downy capsules; "Buckling," a type related to "Microcarpic" but with larger more ovate capsules; and lastly an unnamed type not yet investigated.

Habit and leaf characters can best be shown by photographs of pot and field plants. A few selected mutations will be briefly described and illustrated by the accompanying photographs.

*Polycarpic* (Fig. 8).—The habit and leaf character of the mutant "Polycarpic" shown in Fig. 8 is strikingly different from the normal plant shown as a control in Fig. 7. The most conspicuous peculiarities are its narrow entire leaves and its slow growth. The name was given on account of the frequent presence of extra abortive carpels within the flower.

*Globe* (Fig. 9 and 10).—The "Globe" mutation was the first to be discovered, perhaps because it is one of the most distinct of the variant forms and shows in less degree than most of the mutants the lack of vigor seemingly characteristic of abnormal types in this as in other species. It was named on account of the depressed globose capsules already illustrated. The leaves are broader and less indented than normals and the foliage tends to be more compactly massed at the ends of branches. "Globe" mutants are recognizable at an early stage, frequently at or before the opening of the second leaves. Fig. 10 shows at the left a typical "Globe" seedling which, with its broader entire leaves is easily distinguished from the normal plant of the same age beside it.

*Cocklebur* (Fig. 11 and 12).—The "Cocklebur" mutant was so called because of the small, narrow capsules already illustrated. It was first recognized as



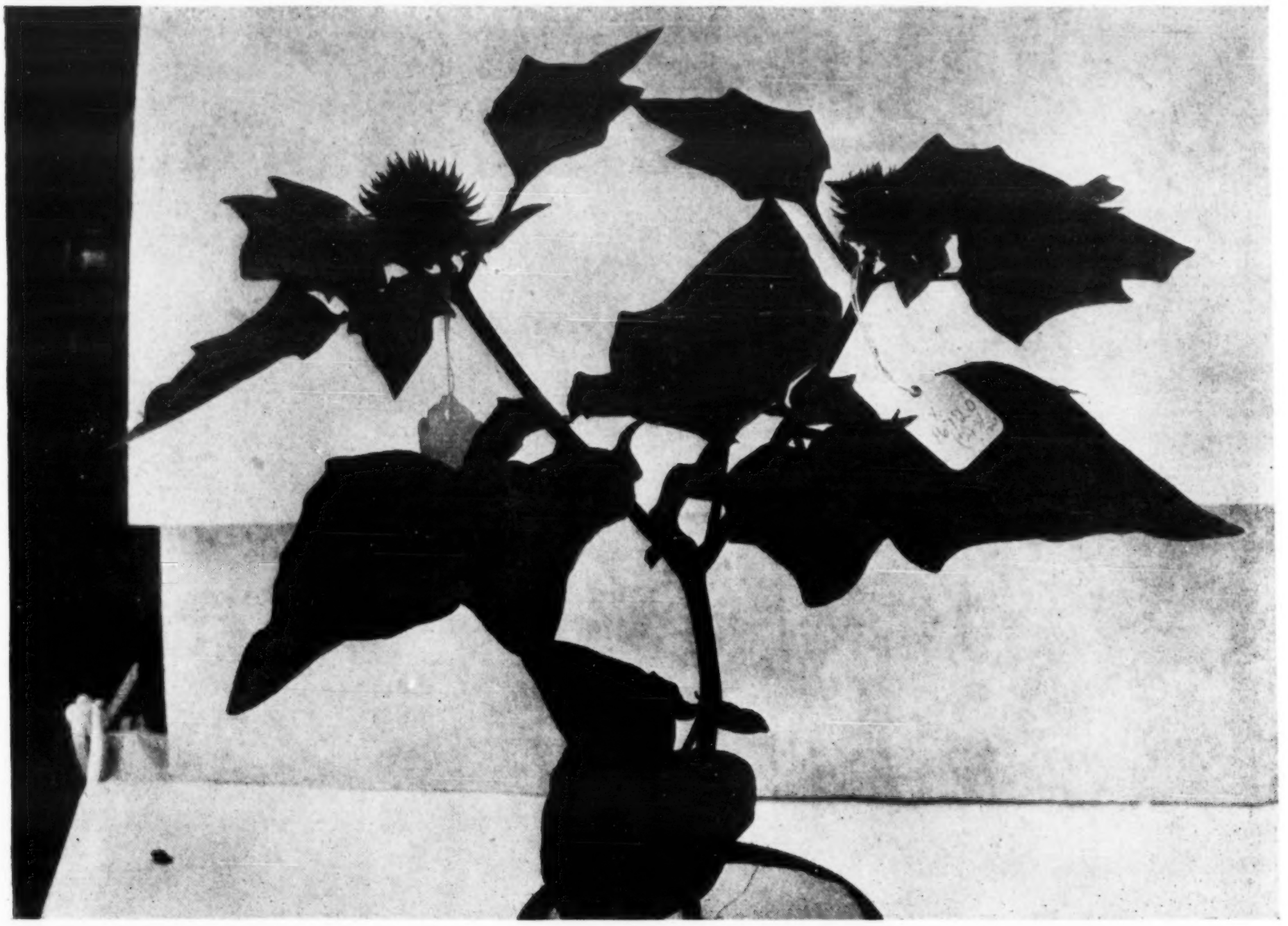
**"POLYCARPIC" JIMSON WEED**

The habit and character of this mutant is strikingly different from the normal plant shown in (Fig. 7). The most conspicuous peculiarities are its narrow entire leaves and its slow growth. (Fig. 8.)

a distinct type from its narrow, slightly toothed leaves. Fig. 8 is typical in habit for pot-grown plants inasmuch as the stems are weak and inclined to droop when grown under greenhouse conditions. In Fig. 12, a typical "Cocklebur" seedling is shown at the left beside a normal from the same pedigree. The differences are such that these mutants can usually be picked out in the seedpan.

"*Poinsettia*" (Fig. 14).—The mutant "Poinsettia" is one of the most distinct in habit of all the mutants so far discovered. Its long, narrow, dark-green leaves are clustered at the ends of the branches in a fashion suggestive of the plant from which it has been named. Masses of adventitious buds often extrude from the young stems, causing irregularities in the branching and increasing its strangeness of appearance. For comparison with this and the next mutant to be described, there is shown in Fig. 13 a few-noded normal plant on the left and a many-noded normal on the right.

"*N. S.*"—The original plant of the mutant provisionally designated by "N. S.," the initials of the words New Species, is represented in Fig. 15. This plant proved sterile in several attempted crosses with normals although fertile with itself and with its own offspring produced by self-pollination. Further tests have shown that the mutant differs from all others investigated in that it breeds true and seems to have established itself as a distinct new race which is almost entirely, if not absolutely, sterile with other forms. This physiological incompatability between a muta-



**"GLOBE" JIMSON WEED**

Named on account of the depressed globe capsules. The Globe was the first to be discovered perhaps because it is one of the most distinct of the variant forms. (Fig. 9.)

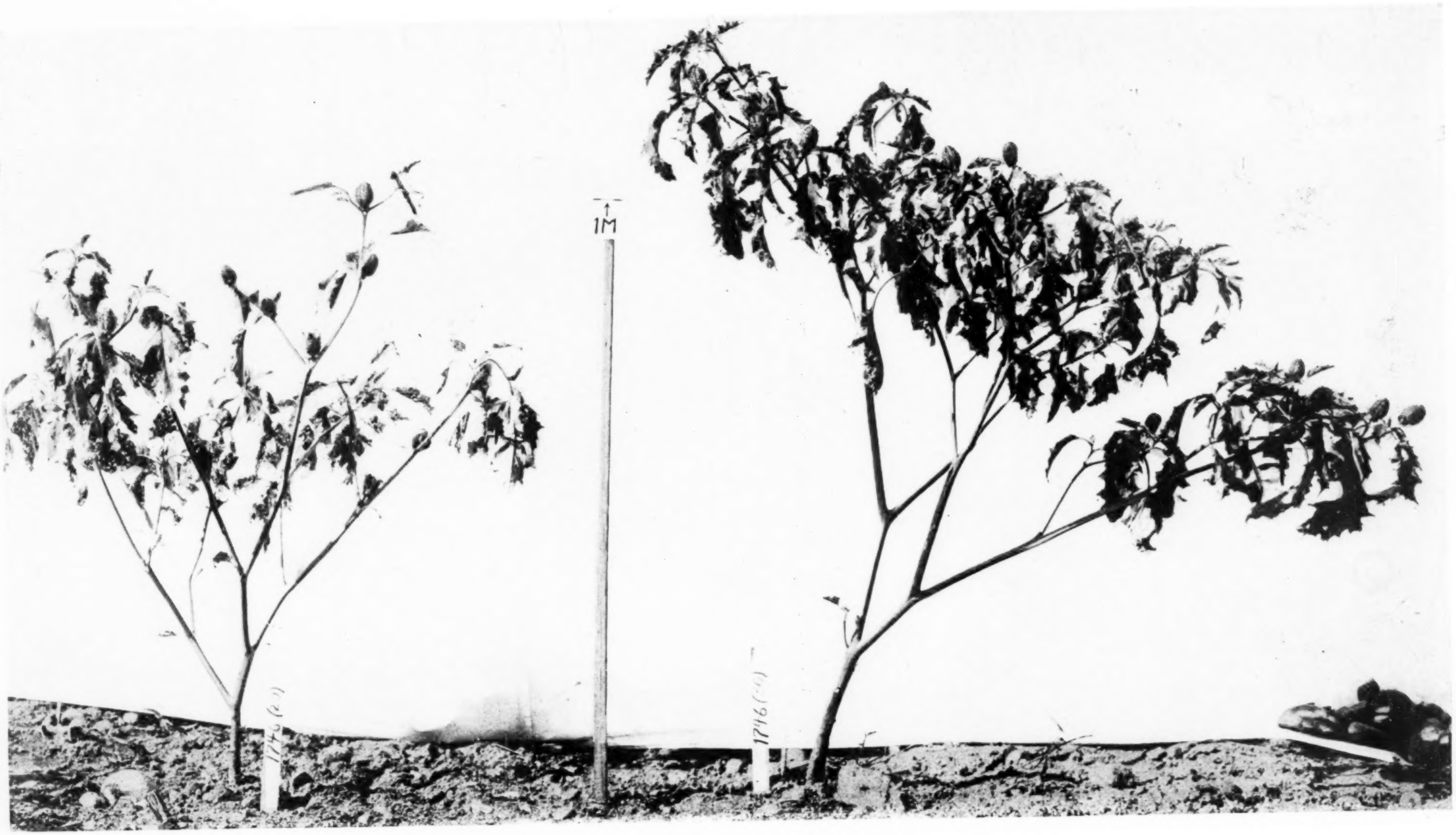
**YOUNG "GLOBE" MUTANT.** (Fig. 10.)

**ADULT "COCKLEBUR" MUTANT**

It was first recognized as a distinct type by its narrow, slightly-toothed leaves. A typical pot-grown plant. Its stems are weak and inclined to droop when grown under greenhouse conditions. (Fig. 11.)

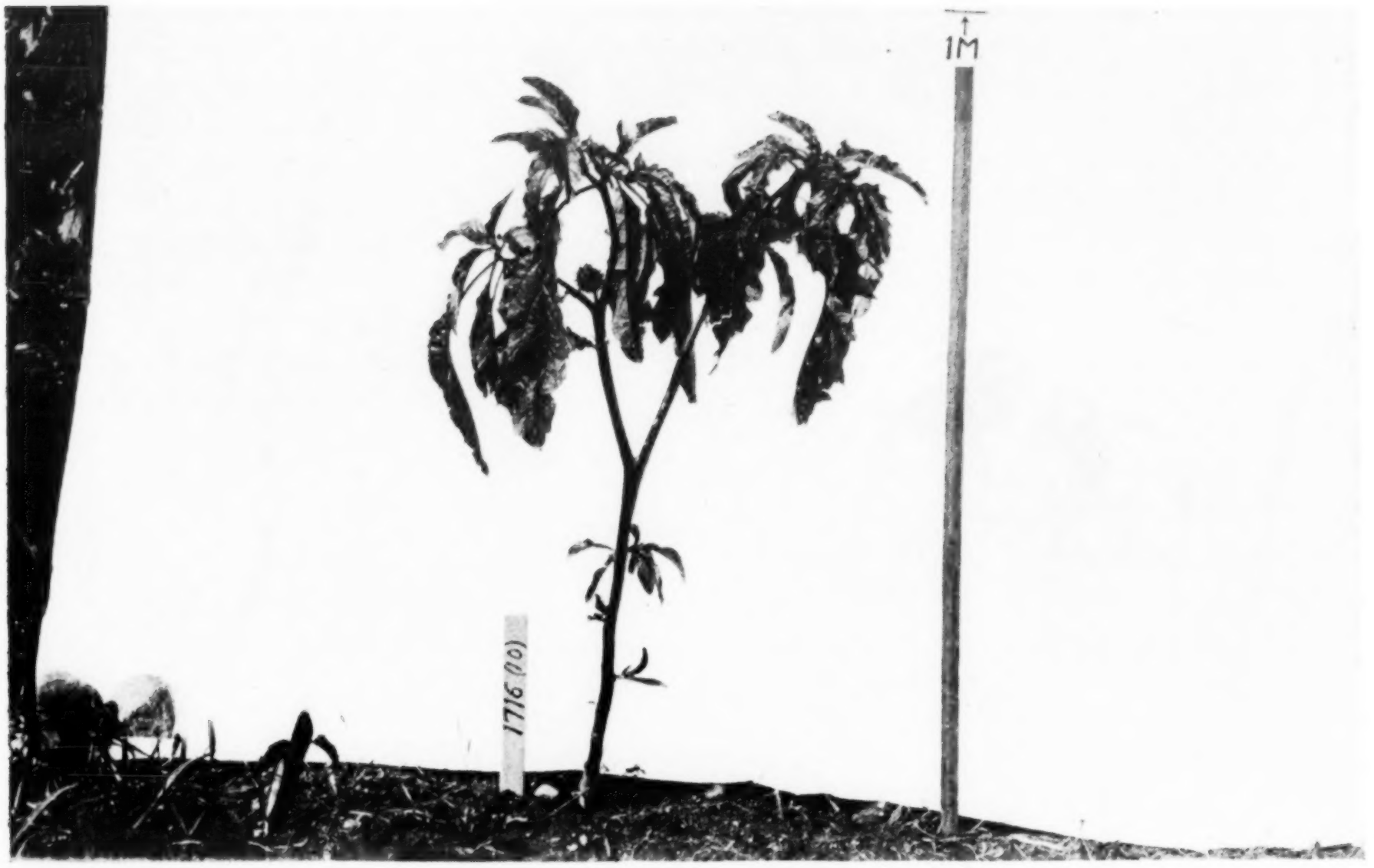
**"COCKLEBUR" SEEDLING AND NORMAL SEEDLING**

The "Cocklebur" seedling, at the left, is distinguishable from the normal seedling, at the right. (Fig. 12.)




**TWO SPECIMENS OF JIMSON WEED**

The common Jimson Weed furnishes a good illustration of Mendelian phenomena. Purple and green stems, spiney and smooth capsules obey the laws. A number of mutants have also been observed. Field-grown, many-noded normal on the right; few-noded normal on the left. (Fig. 13.)




**THE MUTANT "POINSETTIA"**

This mutant is one of the most distinct in habit of all the mutants so far discovered. Its long, narrow, dark-green leaves are clustered at the ends of the branches in a fashion suggestive of the plant from which it has been named. (Fig. 14.)

**"NEW SPECIES" OR "N. S." MUTANT**

This plant proved sterile in several attempted crosses. Tests have shown that this mutant differs from all others investigated in that it breeds true as a distinct new race. Here we appear to be witnessing the birth of a new species. (Fig. 15.)

tion and the parent species from which it arose suggests that we have actually been witnessing in our controlled pedigrees the birth of a new species which may be capable of maintaining itself in a mixed population uncontaminated by crossing with its ancestral line. The race is relatively vigorous. In some respects it resembles the "Globe" mutation, although not readily confused with the latter type. The leaves are considerably larger and the capsules, while roughly spherical in outline, are not so depressed at the apex nor armed with such stout spines.

We have shown in this brief presentation that the Jimson Weed possesses characters inherited in simple Mendelian manner; that, in addition, numerous mutations, several of which are figured, have arisen in our cultures; that these mutations transmit their characters as a complex, usually to only a part of their offspring, that the inheritance is chiefly through the female sex; that, in a single instance, a mutation has arisen which seems to have established a distinct race or new species, breeding true but seemingly unable to cross with the species from which it has had its origin.

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### Live-Stock Production Helped by County Agents in North and West

Production of more and better live stock with less expensive feed and greater profit to the producers is given attention by county agents in nearly every county in the thirty-three northern and western states.

During the fiscal year 1918 the agents assisted in the organization of 160 live-stock breeders' associations to encourage the use of better sires, and 182 cow-testing associations to eliminate unprofitable cows and bring about more economical feeding. Through these associations and those organized with the assistance of agents in previous years 127,835 cows were under test, resulting in at least 8,724 cows being discarded as unprofitable. Primarily, through these organizations, 10,986 farmers were induced to adopt balanced rations for their herds, and the following number of registered stock were secured at suggestion of agents: Bulls, 3,285; cows, 4,836; rams, 1,469, and boars, 2,974. The agents also brought about the transfer to other herds of 3,370 valuable registered sires by means of information given to individual farmers or through exchange lists published by the farm bureaus.

In some states a special effort was made to save calves from being slaughtered for veal, resulting in 10,499 additional calves being raised. This work was carried on most extensively in Wisconsin, from which 2,459 calves from high-grade or registered stock were shipped for breeding stock to Missouri, Wyoming, and other western and southern states.—*Weekly News Letter, U. S. Dept. of Agriculture.*

# THE DETERMINATION OF DISPUTED PARENTAGE AS A FACTOR IN REDUCING INFANT MORTALITY

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WHILE juries have been called upon to compare in court the features of children and alleged parents, the uncertainty of such superficial comparisons has prevented any important legal use of the determination of parentage. The most widely known of such cases have been in cases of contested wills or titles. These cases, while spectacular, represent only a small part of the very wide application that would be made of this method, were it possible to unerringly establish parentage in illegitimacy cases. At the present time, if an illegitimate mother sues an alleged father for the support of her child, the defense on his part is usually that some other person might have been the father of the child, and because of difficulty of rebutting this defense under the present methods, it has been very difficult to fasten the support of the child on the father. If it is possible to elaborate methods by which parentage can be surely determined, so that alleged parentage can be definitely proven or disproven, then the support of the child can be fastened upon the father in cases where he can be located and has the necessary income.

The admissibility of the child for the inspection[1] of the jury is now well established for children over two[2] years of age, but the preponderance of decisions excludes this evidence for establishing resemblances below that age, on the ground that the child's features have not yet acquired maturity and permanence. In our present state of knowledge this rule can be little criticized, but

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[1] For admissibility of child for inspection:
Gilmanton *vs.* Ham, 38 N. H., 108.
State *vs.* Arnold, 13 Ired. (N. C.), 184.
Finnegan *vs.* Dugan, 96 Mass., 197.
State *vs.* Woodruff, 67 N. C., 89.
Morrison *vs.* People, 52 Ill. App., 482.
State *vs.* Smith, 6 N. W., 153. (2 years 1 month.)
Scott *vs.* Donovan, 26 N. E., 871. (Regardless of age.)
Gaint *vs.* State, 14 Atlantic, 600.
Kelly *vs.* State, 133 Ala., 195.
Shailer *vs.* Bullock, 78 Conn., 65. (10 months.)
Higley *vs.* Bostock, 79 Conn., 97.
State *vs.* Sardell, 46 A., 1083.
Brantley *vs.* State, 65 Ia., 678.
Lard. *vs.* State, 1055 W., 90.
Sins *vs.* State, 84 S. E., 976.
State *vs.* Browning, 152 P., 672.
Smith *vs.* Hawkins, 47 S. O., 429.
Commonwealth *vs.* Pearl, 33 Pa. Super. Ct., 97.
Robnett *vs.* The People, etc., 16 Ill. Appellate Court, 299.

[2] Against admitting a very young child:
Clark *vs.* Bradstreet, 80 Me., 454. (6 weeks old.)
Hanawalt *vs.* State (1885), 64 Wis., 84. (Younger than 1 year.)
Overlook *vs.* Hall, 81 Maine (1889). (6 months old.)
State *vs.* Harvey, 84 N. W., 535. (9 months old.)
State *vs.* Danforth, 48 Iowa, 43. (3 months old.)
Rush *vs.* State, 19 Indiana, 152. (3 months old.)
Ingram *vs.* State, 37 N. W., 943.
Shorter *vs.* Judd, 42 Pacific, 337. (At an age when its features have not assumed some degree of maturity and permanence.)

it is evident that it is while the child is still below two years that it is most necessary that the parentage should be established so that the child shall be supported. Since the objections of the court are solely based on the uncertainty of determination by mere inspection, there is every reason to believe that should a method be developed that would make the determination possible from birth onward, that the courts would interpose no objection.

However, we have so far considered the admissibility of the child itself as an exhibit. There remains the question of the admissibility of the opinion of persons as to the alleged resemblance. In two cases photographs[3] have been admitted, but the courts have been very reluctant to admit the judgment of witnesses,[4] and the preponderance of the decisions is against their admission. Yet we have three cases in which there is clear discrimination as to the ability of witnesses to reach an opinion of value. I shall quote the language of the courts in these cases, Clark *vs.* Bradstreet, 80 Me., 454: "The testimony of witnesses where they have no special skill or knowledge in such matters has never been admitted in the state (Maine)." Eddy *vs.* Gray, 4 Allen, 438. "The evidence she offered as to the supposed resemblance of the child to the defendant was properly rejected. It is not of the kind which comes within the rule in relation to the testimony of experts upon questions of science or of skill or of knowledge acquired by some peculiar experience or education. The witness called did not profess to have any special skill upon the subject of inquiry." Keniston *vs.* Rowe, 16 Me., 38. "Witnesses who have had sight of the persons might be indefinitely multiplied, without affording any satisfactory. ground of judgment for a jury. Witnesses except in some art, trade or profession requiring peculiar skill and science are not called to form comparisons and to testify to opinions arising from them."

It is quite evident therefore that the court has already laid the ground for real expert testimony on this subject when methods that yield reliable results shall have been elaborated. The reasons why the elaboration of such methods would be so desirable are the following: (1) The number of illegitimate children will be cut down, if the prospective father knows that his paternity can be detected and the support of the child fastened upon him. Second, the care of the child would be very much better and hence its mortality risk appreciably reduced. This we may conclude from the well-known contrast between the death rate of illegitimate and legitimate children, most of which must be attributed to the better support of the latter class. Having, then, seen the great need for such a method, let us examine our knowledge of heredity to see whether such a method is feasible.

There are four distinct methods that might be employed, and while the

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[3] Photograph was admitted and bearing on resemblance.
State *vs.* Patterson, 100 N. W., 162.
Shorter *vs.* Judd, 42 Pac., 337.

[4] State *vs.* Woodruff, 67 B. C., 89. (It allows all persons to testify to such identity or to such resemblance who have had an opportunity of seeing the persons, if but for an instant.)
Douglas Peerage Case, House of Lords, 1769.
Day *vs.* Day, Huntington Assize, 1797.
Paulk *vs.* State, 52 Ala., 427. (The defendant may prove that the child bears no likeness to him or that it resembles another man who had opportunity of illicit intercourse with the mother.)
Jones *vs.* Jones, 45 Mary, 151. (1876.)
Keniston *vs.* Rowe, 16 Maine, 38.
Eddy *vs.* Gray, 4 Allen, 435.
W. Calman *vs.* State, 49 S. E., 612.
Shorter *vs.* Judd, 42 Pacific, 337.
Hanawalt *vs.* State, 64 Wis., 84.
Keniston *vs.* Rowe, 16 Mo., 38.
Young *vs.* Makepeace, 103 Mass., 50. (We think also that the testimony to show points of similarity between the child and the parent should not have been admitted; even where there is a noticeable resemblance there may be equally marked points of dissimilarity.)

method to be mentioned last is believed by the writer to be the method of greatest reliability, the first three methods to be mentioned will have some corroborative value, especially in giving more concrete evidence to skeptical jurors in the first few years of the application of the method.

1. The alternative inheritance of many abnormalities. Davenport in his "Heredity in Relation to Eugenics" has a list of many abnormalities which are inherited alternately and in a more or less Mendelian manner. In those cases where there is present one of these abnormalities in both the suspected parent and the child, we have corroborative evidence, but this method alone can be of limited use only.

2. More uniform application of the alternative inheritance of certain human traits which are inherited in a more or less Mendelian fashion, such as hair, eye and skin color. Since there is always some color, this comparison is possible in all cases, in contrast to the first class where the abnormality is only occasionally present. Conclusive evidence is hardly to be expected, although the evidential value becomes greater where both parent and child had some one recessive characteristic. It is true that there is a court decision where evidence as to eye color[5] was ruled out, and a similar one in respect to hair color, but it is evident that the judge's reason in each case was not that these traits were thought by him not to be inherited in some degree, but a justifiable fear lest this evidence alone might too greatly influence the jury, in view of the importance of reaching conclusions as to parentage only on the basis of many traits.

3. The papillary ridges of the palm and sole. Prof. H. H. Wilder, of Smith College, and other workers have now well established that there is a large rôle of heredity in the determinations of the patterns of these lines on the palm and sole. These are the lines so well known in the finger prints now so frequently taken for identification purposes. I can vouch for this because I have on the palm of one of my hands one peculiar feature of the palm pattern common to my mother, myself and my older son. The use of the palms and soles is decidedly superior to the class of evidence heretofore discussed, but since it does not lend itself as yet readily to statistical analysis, we must look mainly to the last method, the anthropometric.

Anthropometry, or the science of human measurements, offers us the main reliance because by taking one hundred measurements on the child, on the suspected parent, and on the known parent, if the other parent be known, it will be possible to establish an index of correlation which will run very much higher in the case of real parentage than where there is no relation. The one hundred measurements to be taken should include a number on the ear, for the reason that this organ is peculiarly unsusceptible to modifications and to change in its proportions during life. Where the ear has been pierced, the lobal characteristics should be rejected, and possibly also the amount of projection from the head should be rejected as having too much of the modification element. Head shape and facial features should be used for a large number of measurements because of their remarkable variability. The other measurements would be those where the measurement is primarily a skeletal one, little affected by the weight and health of the individual. Davenport has shown that different skeletal dimensions may be inherited independently. There are two disturbing factors which should be recognized. One is the change in proportion between male and female. This is readily provided for by the use of correction factors which eliminate sex differences. A more disturbing element is change of proportion with age, but this again can be largely eliminated by the use of correction factors.

There remains now to discuss the feasibility of this method. In the first place, a large number of measurements must first be made on parents and their

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[5] People *vs.* Carney, 29 Hun. (N. Y.), 47, 49 (1883). (Evidence of the color of the child's eyes is not admissible to show its paternity.)

children in order to establish norms and correction factors, and also to determine the amount of difference in the correlation indices where the parental relation exists and does not. An appropriation of $35,000 could be depended upon to give results in two years. The method of attack is well understood by competent students of heredity, and it merely requires the decision of some institution to undertake the investigation. The writer suggests that the Children's Bureau at Washington would be the best agency, but since the governmental initiative is sometimes difficult to invoke, it may be possible that we must look to the Carnegie Institute of Washington or the Rockefeller or the Sage foundation for the preliminary work.

After the methodology has been perfected, how shall the method be actually used? It is my belief that this work should not be done by private experts hired by one or the other of the litigants, the system by which expert witnesses are usually employed, but which is nearly universally disapproved by those who have given the matter attention. Better, let the court call upon the Disputed Parentage Division of the Children's Bureau to make the determination and report to it, the Children's Bureau making an appropriate charge to the court for the services. By eliminating the danger of bias, this will greatly increase the confidence of judges and juries in the decisions.

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## Rabbit Raising Pays in Utah

In Utah many boy and girl club members are going into the rabbit-raising business, finding it most profitable, according to word received by the States Relations Service, United States Department of Agriculture. They have found that it costs about 25 cents to raise a rabbit to the age of three months, and that at that time it may be marketed at 35 or 40 cents a pound. The pelts bring from 15 to 75 cents, depending on the kind of rabbit and its size. Compared with poultry, rabbit raising in Utah has proved much more economical, as rabbits are very hardy and require no expensive feed. For example, one club boy reports that he feeds only oats, cabbage, and water. In some places in the state the demand exceeds the supply. Hotels and restaurants, which serve rabbit as often as they do chicken, are the chief buyers. The Bureau of Biological Survey and the Bureau of Markets are coöperating actively in developing interest in the production and marketing of domesticated rabbits and in standardizing methods of handling these animals and the wild rabbits which are killed for sport or to protect crops from their depredations.—*Weekly News Letter, U. S. Dept. of Agriculture.*

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## Boys Teach Fathers Better Hog Raising

Some of the boys in the two Dekalb County, Ind., pig clubs are showing their fathers how rapid and economical gains can be made in raising pigs. Under the direction of the local county agent these boys have been able to almost double the results obtained by their fathers within the same length of time and feeding pigs of the same litter. The boys used self-feeders and the fathers did not, and the pigs which were allowed to select their own feed made gains of 2 pounds a day. The club members are proving, beyond question, the merits of the self-feeder, and hog raisers in the county of many years' experience are beginning to copy the boys' methods. As a result of the club work, the county agent reports, many fathers and sons are now planning to go into partnership and raise pure-bred hogs.—*Weekly News Letter, U. S. Dept. of Agriculture.*

# IMMIGRATION RESTRICTION AND WORLD EUGENICS

PRESCOTT F. HALL

THERE is one aspect of immigration restriction in the various countries which does not often receive much attention, namely, the possibility of its use as a method of world eugenics. Most persons think of migration in terms of space,—as the moving of a certain number of people from one part of the earth's surface to another. Whereas the much more important aspect of it is that of a functioning in time.

This comes from two facts. The first is that the vacuum left in any country by emigration is rapidly filled up through a rise in the birth rate. There are more people in England today than in the time of Elizabeth, in spite of the enormous emigration from that country, to all parts of the world; and there are just as many sparrows in England today in spite of the unfortunate spread of those birds in the United States. The vacuum is chiefly filled by the breeding of the lower classes. The vacuum is chiefly filled by the breeding of the lower classes. Thus, according to Professor Pearson, more than one-half the births in England are now from the lowest one-sixth of the population. In Italy, a similar condition fills the vacuum left by the very large emigration from there to North and South America.

The second fact is that immigration to any country of a given stratum of population tends to sterilize all strata of higher social and economic levels already in that country. So true is this that nearly all students of the matter are agreed that the United States would have a larger population today if there had been no immigration since 1820; and, it is needless to add, a much more homogeneous population. As long as the people of any community are relatively homogeneous, what differences of wealth and social position there may be do not affect the birth rate, or do so only after a considerable time. But put into that community a number of immigrants, inferior mentally, socially and economically, and the natives are unwilling to have their children associate with them in work or social life. They then limit the number of their children in order to give them the capital or education to enter occupations in which they will not be brought into contact with the new arrivals. This result is quite apparent in New England where successive waves of immigration from lower and lower levels have been coming in for eighty years. In the west, the same New England stock has a much higher birth rate, showing that its fertility has in no way diminished. In the south, where until very recently there was no immigration at all, and the only socially inferior race was clearly separated by the accident of color, the birth rate has remained very high, and the very large families of the colonial period are even now not uncommon.

This is not to say that other causes do not contribute to lower the birth rate of a country; for that is an almost world-wide phenomenon. But the desire to be separated from inferiors is as strong a motive to birth control as the desire for luxury or to ape one's economic superiors. Races follow Gresham's law as to money; the poorer of two kinds in the same place tends to supplant the better. Mark you *supplant*, not drive out. One of the most common fallacies is the idea that the natives whose places are taken by lower immigration are "driven up" to more responsible positions. A few may be pushed up; more

are driven to a new locality, as happened in the mining regions; but most are prevented from coming into existence at all.

What is the result then of the migration of a million persons of lower level into a country where the average is of a higher level. Considering the world as a whole, there are, after a few years, two million persons of the lower type in the world, and probably from half a million to a million less of the higher type. The proportion of lower to higher in the country from which the migration goes may remain the same; but in the country receiving it, it has *risen*. Is the world as a whole the gainer?

Of course, the euthenist says at once that these immigrants are improved. We may grant that, although the improvement is probably much exaggerated. You cannot make bad stock into good by changing its meridian, any more than you can turn a cart horse into a hunter by putting it into a fine stable, or make a mongrel into a fine dog by teaching it tricks. But such improvement as there is involves time, expense and trouble; and, when it is done, has anything been gained? Will anyone say that the races that have supplanted the old Nordic stock in New England are any better, or as good, as the descendants of that stock would have been if their birth rate had not been lowered?

Further, in addition to the purely biological aspects of the matter, there are certain psychological ones. Although a cosmopolitan atmosphere furnishes a certain freedom in which strong congenital talents can develop, it is a question whether as many are not injured as helped by this. Indeed, there is considerable evidence to show that for the production of great men, a certain homogeneity of environment is necessary. The reason of this is very simple. In a homogeneous community, opinions on a large number of matters are fixed. The individual does not have to attend to such things; but is free to go ahead on some special line of his own, to concentrate to his limit on his work, even though that work be fighting the common opinions. But in a community of many races, there is either cross-breeding or there is not. If there is, the children of such cross-breeding are liable to inherit two souls, two temperaments, two sets of opinions, with the result in many cases that they are unable to think or act strongly and consistently in any direction. The classic examples are Cuba, Mexico and Brazil. On the other hand, if there is no cross-breeding, the diversity exists in the original races, and in a community full of diverse ideals of all kinds much of the energy of the higher type of man is dissipated, and in two ways. First, in the intellectual field there is much more doubt about everything, and he tends to weigh, discuss and agitate many more subjects, in order to arrive at a conclusion amid the opposing views. Second, in practical affairs, much time and strength have to be devoted to keeping things going along the old lines, which could have been spent in new research and development. In how many of our large cities today are men of the highest type spending their whole time fighting, often in vain, to maintain standards of honesty, decency and order, and in trying to compose the various ethnic elements, who should be free to build new structures upon the old!

The moral seems to be this: Eugenics among individuals is encouraging the propagation of the fit, and limiting or preventing the multiplication of the unfit. World eugenics is doing precisely the same thing as to races considered as wholes. Immigration restriction is a species of segregation on a large scale, by which inferior stocks can be prevented from both diluting and supplanting good stocks. Just as we isolate bacterial invasions, and starve out the bacteria by limiting the area and amount of their food supply, so we can compel an inferior race to remain in its native habitat, where its own multiplication in a limited area will, as with all organisms, eventually limit its numbers and therefore its influence. On the other hand, the superior races, more self-limiting than the others, with the benefits of more space and nourishment will tend to still higher levels.

This result is not merely a selfish benefit to the higher races but a good to the world as a whole. The object is to produce the greatest number of those fittest not "for survival" merely but fittest for all purposes. The lower types among men progress, so far as their racial inheritance allows them to, chiefly by imitation and emulation. The presence of the highest development and the highest institutions among any race is a distinct benefit to all the others. It is a gift of psychological environment to anyone capable of appreciation.

It is important, therefore, that nothing in the constitution of the League of Nations should limit the right of any nation to decide who shall be admitted into its life; for, as Le Bow says, a preponderance of foreign elements destroys the most precious thing it possesses—its own soul.

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# TWO STRIKING COLOR VARIATIONS IN THE GREEN FROG

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IT IS well known to every student of pond life that the common green frog, Rana clamitans Latrielle, show many variations in color. Typically, the coloring is bright metallic-green on head and shoulders and dusky olive, more or less spotted, posteriorly. The throat is orange-yellow in the male, white in the female.

The dark coloration of frogs is due to a layer of black pigment cells under the epidermis. Under the influence of various stimuli, these cells have the power of changing shape. Expansion produces a dark color, contraction a dilution effect. Mary C. Dickerson, in *The Frog Book*, explains the production of green color as follows:

"Green color is not produced directly by a pigment, but as the result of black and yellow pigments and a structure, namely, the so-called interference layer. This is a single layer of polygonal cells between the epidermis and the black pigment layer. These cells contain minute yellow particles, which crowd to the sides of the cells next the epidermis. If these cells were empty, the result would be simply that the black pigment layer would be farther from the surface and would be seen through the interference layer. This would make the color appear blue instead of black, giving the ordinary color phenomenon of dense media, as seen in the color of the sky (*i. e.*, all the light waves of great wave lengths are absorbed and only those of short lengths are reflected). When the interference cells contain yellow, the blue is seen through the yellow, and the resultant color is green.

"The green color thus produced may be more blue or more yellow, and may change to brown when the black pigment cells expand greatly and press close about the cells of the interference layer, thus diminishing the density. A fragment of the outer skin of a green tree frog, examined from underneath, of course appears black, because we are looking directly at the black pigment layer. The same piece looked at from above and against the light appears brown, but examined from above with light from above it appears green and shows the polygonal cells of the interference layer.

"Therefore, frogs that have the interference layer and black and yellow pigments appear green or brown, and can change from one to the other with great rapidity."

The same principle of color produc-

tion is illustrated by blue or greenish eyes in man, by greenish eyes in cats, and by the blue-eyed white cat. Thus the blue eye has dark pigment on the posterior side of the iris, while in the greenish eye there is a certain amount of yellow pigment on the front of the iris as well. The blues seen in many birds and butterflies are similarly due to the presence of dark pigment underlying modifying structures, and greens are produced by the addition of yellow pigment.

### CREAMY WHITE FROGS

The two color variations in the green frog, with which the present paper is concerned, were noticed in specimens brought to the zoölogical laboratory of the University of Pennsylvania in the fall of 1916. Yellow pigment was entirely lacking from the skin, and the dark pigment was reduced to a very light sepia, barely visible on the back and head. The skin in general appeared creamy white. The iris was black, showing that, while the yellow pigment normally present was eliminated, the black was here reduced but little, if any. The pupil was dark.

This variation is apparently comparable to that described by Haecker[1] in the tiger salamander. He found partially albinic forms which showed more or less gray color in the skin. Yellow pigment was lacking. The iris was in all cases black, but, unlike that of the albinic frogs, the pupil was reddish, due to reduction of the dark pigment in the retina. The variation described by Haecker acted as a simple Mendelian recessive.

### ALBINO FROGS

The other variation in the green frog was represented by a single specimen, which was brought to the laboratory in the fall of 1917. This was a young frog lacking black pigment entirely. The skin of the back, sides and head was clear light yellow. The only trace of a darker color was a very slight greenish shade in the skin about the eye. The iris was clear gold; the pupil, pink.

Dr. Sewall Wright, in an interesting series of articles on color inheritance in mammals,[2] has developed the theory that there are two enzymes for color production. "Enzyme I" is the fundamental enzyme, which, acting alone on chromogen, produces yellow pigment. "Enzyme II" has no effect on chromogen directly, but in combination with "Enzyme I" develops dark pigment. It appears quite probable to me that Wright's theory may be extended to other groups, such as birds, amphibia, and insects.

The albinic variation in the tadpoles here described, as well as in Haecker's salamanders, would then be due to a factor determining extreme, though not complete, reduction in "Enzyme I." The yellow frog, on the other hand, would have "Enzyme II" almost entirely eliminated. If the whitish forms differed from the normal variety by the loss of a certain color factor, C, and the yellow differed by the loss of a dark color developer, D, they would reconstitute the common form when crossed. Thus albino, ccDD, by yellow, CCdd, gives normal, CcDd. If these were inbred, we should obtain nine (CD) normal, three (ccD) albinic, three (Cdd) yellow, and one (ccdd) which, lacking both factors, should be pure white with pink iris and pupil, for cc eliminates all yellow and dd eliminates all black and brown. It is unfortunate that the specimens could not be reared and tested, but it has seemed worth while, in view of the striking character of the variations noted and the apparent correlation with color factor differences in mammals, to put the matter on record. The writer would be interested to hear of other similar variations.

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[1] Haecker, V. 1911. Allegemeine Vererbungslehre. Friedr. Vieweg & Sohn, Braunschweig.

[2] Wright, Sewall: "Color Inheritance in Mammals," Journal of Heredity, Vols. viii and ix, 1917-18.

# BUD VARIATIONS IN SUGAR CANE

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THE occurrence of bud mutations in cultivated plants has long been known and the commercial value of many such forms has been recognized. Several hundred bud varieties of fruits, flowers, and other plants grown for their economic or ornamental value are in more or less general cultivation at the present time. As examples of such varieties mentioned may be made of the Washington Navel orange, the Pima cotton and several forms of the Nephrolepis fern.

A recent study of plant varieties known to have originated as bud mutations disclosed the importance of such forms in the development of the cane sugar industry. The following account of the bud origin of several sugar-cane varieties is presented in the hope that it may reach a wider distribution among students of genetics than was secured by the publications reviewed, *i. e.:* (1) *The West Indian Bulletin*, vol. 2, No. 3 (1901 or 1902), pp. 216-223, "Bud Variation in the Sugar Cane." (2) "Cane Sugar," Noel Deerr, London, 1911, pp. 23-38.

Anyone especially interested in this subject should consult these articles, as Mr. Deerr's book has colored plates of several of the bud-varieties described and the figures reproduced herewith are shown in color in the *West Indian Bulletin.*

Sugar cane (*Saccharum officinarum* Linn.) is one of the most important of our economic crops, and yet the development of the scientific study of it dates back but little over a generation. This is probably due largely to the confinement of its cultivation to widely scattered districts, most of which are remote from the older centers of civilization and to the decentralized development of the industry.

Previous to 1885 it was generally believed that the flowers of the sugar cane were infertile, notwithstanding that there are several earlier recorded instances of the occurrence of seed. All propagation was by the planting of joints of the stalks, and it is believed that practically all the varieties in commercial cultivation up to within the last twenty-five years originated as bud variations.

Since the rediscovery of the fertility of the flowers of the sugar cane, which was made independently by Soltwedel in Java in 1888, and by Harrison and Bovell in Barbados in 1889, valuable varieties have been developed as seedlings. Commercial propagations are still made entirely by planting pieces of the stalk. Seed propagation is only practiced in the search for new varieties, as seedlings show the characters of their parents in but very slight degrees.

## VARIATIONS FROM STRIPED VARIETIES

The earliest recorded instance of bud variation in the sugar cane is given by Mr. J. F. Horne,[1] then Director of Forests and Botanical Gardens in Mauritius. In describing canes imported into Mauritius he wrote: "Two plants were found, one of which, while producing striped canes from one eye, produced green canes from another eye, both of which eyes belonged to the same piece of cane, while the second plant

[1] The magazine *Sugar Cane*, No. 17.

Bud variation in sugar cane found on the Kirton plantation, Barbados. From West Indian Bulletin, Vol. 2, No. 3. (Fig. 16.)

produced both striped and green canes from one and the same eye."

A very similar observation was made by Melmoth Hall[2] a little later. He wrote: "I have in one instance seen no less than three distinct canes springing from one stool of the ribbon variety, one entirely yellow, one entirely green, the other being the usual ribbon cane; while from other stools in the same field I found canes either of a uniform green, purple or purplish-brown; all the rest spring from the same ribbon cane root, being striped in the usual way."

Mr. Deerr, writing in 1910, said that for generations the Louzier (Otaheite) cane, known under several names in different sections, had produced a very large proportion of the world's supply of sugar cane combining the characteristics of heavy tonnage, sweet and pure juice, and low fiber content. M. Auguste Villele, of Mauritius, thus described the origin of this variety in a letter to Mr. Deerr: "In 1868 or 1869 M. Lavignac introduced into Mauritius several varieties of cane from New Caledonia, among which was the Mignonne, a red and green striped variety. This cane was noticed by M. Louzier to throw sports and from a yellow sport the Louzier was developed, being the standard cane of Mauritius for many years."

The Louzier cane traveled from Mauritius to other districts and is not to be distinguished from the Yellow Otaheite cane of Cuba and Java, or from varieties grown under other names in several sugar-cane districts. Mr. Deerr states that, having seen the Bourbon, the Lahaina, and the Louzier growing on a large scale in Demerara, Hawaii, and Mauritius, he has no hesitation in saying that they are indistinguishable. Stubbs[3] and Harrison and Jenman[4] also considered these varieties identical. It is then reasonable to suppose that the Lahaina and Bourbon canes, although introduced into Hawaii and the West Indies as self-colored canes, were originally in Otaheite sports from the cane introduced into Mauritius in 1868 or 1869 under the name Mignonne, and that in Otaheite the latter was cultivated as a separate cane.

Assuming the identity of the Louzier with the Otaheite and Lahaina canes as described above, and remembering the origin of the first mentioned, it is also probable that the other two originated in the same way but, having been introduced at early dates as self-colored canes, no suspicion of their origin arose. The Louzier cane also is known to throw a striped sport indistinguishable from the Mignonne from which the Louzier arose, and this cane in turn throws self-colored sports, thus completing the cycle through striped cane, self-colored cane, to striped cane again, although it is impossible to state which was the original type.

In December, 1890, Mr. J. F. Horne wrote the Director of the Royal Gardens at Kew as follows:[5] "Of new varieties originating as bud sports we have eight or nine in Mauritius alone; some of them are very fine canes and they are extensively planted. Most of them are hardier than their parents and they yield more sugar. They are mostly obtained from new canes recently introduced. The sudden change of climate, soil, and other circumstances cause them to be thrown off. More of them might be obtained if the planters were more observing than they are and closely followed the cane cutters throughout their fields. As things are, a new variety is only observed should it chance to spring up in an outside row."

In the early nineties the Striped Tanna canes. Under th name of Yelcolor) was brought to Mauritius, and it was frequently observed to throw sports whence have come the White

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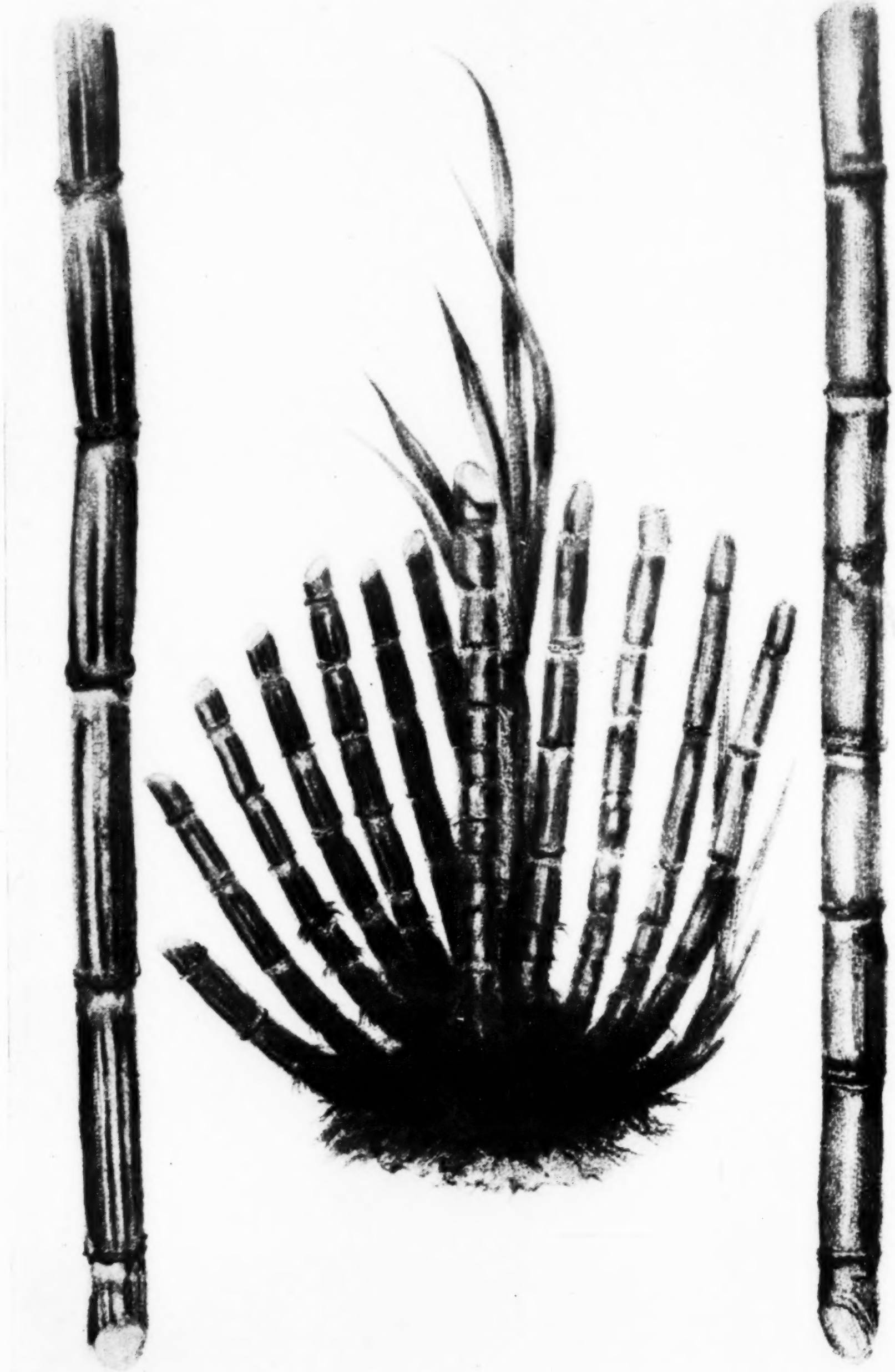
[2] The magazine *Sugar Cane*, No. 64.
[3] Dr. W. Stubbs, *Sugar Cane*, 1897, p. 66.
[4] The magazine *Sugar Cane*, No. 273.
[5] Kew Bulletin, 1891.



Stool of Red Ribbon (Striped Cheribon) sugar cane showing stalks of the Burke or White Cheribon variety appearing as a bud variation. Found by Mr. S. B. Kirton, owner of the Arthur Seat plantation, Barbados, in 1900. From West Indian Bulletin, Vol. 2, No. 3. (Fig. 17.)

(yellow color) and Black (purple color) Tanna canes. Under the name of Yellow Caledonia the White Tanna in 1910 formed the major portion of the unirrigated plantings in the Hawaiian Islands, as Malabar it was the favorite cane of Fiji, and as White Tanna it covered extensive areas in Mauritius. All three of the Tanna canes were also cultivated on a large scale in Australia.

Mr. James Clarke of North Queensland reported that the first instance of bud variation that he noticed was in New South Wales, where he had charge of a large sugar plantation. Having planted with his own hands some of the Striped Tanna cane in an endeavor to establish there a variety resistant to the "gumming" disease, he noticed when cutting the canes that some of them were entirely yellow and some purple without stripes. One stalk was found with the three lower joints striped like Striped Tanna and the upper portion of the stalk unstriped and completely yellow. The yellow and the purple canes were planted separately, as were the joints from the stalk that was partly striped and partly yellow, and in each case the resulting canes were true to the color of the cuttings planted.

The following experiment[6] is reported from Louisiana: "As an illustration of bud variation, some stalks of cane, partly white and partly purple, were selected from the field of Soniat Bros., Tchoupitoulas plantation. They were called bastard canes. These stalks were planted as follows: First row, the entire stalk; second row, the white joints; third row, the colored joints. At the end of the season four distinct canes, as far as color could direct us, were obtained. Types of the four new varieties were selected and separately planted and the next year were found to be nearly pure. Selection and separate plantings have been made each year since. These canes have been named as follows: First, a white cane, No. 29, Soniat; second, a light striped cane, No. 59, Nicholls; third, a light purple cane, No. 64, Bird; fourth, a dark striped cane, No. 65, Garig. The yield and analyses of these canes have been annually made. They, except the white, are entirely different from any other cane in our collection."

An interesting bud variation (Fig. 1) was forwarded by the Hon. F. J. Clarke from Kirton plantation in Barbados to the West Indian Department of Agriculture and was exhibited by Dr. Morris, the Commissioner of Agriculture, at a meeting of the Barbados Agricultural Society in April, 1899. The specimen was a ribbon cane with very pronounced stripes on the main stem. Four successive joints had thrown off shoots, the first and third of which were striped with red like the parent cane, while the second and fourth were unstriped yellow canes. The resulting appearance was a striped parent cane bearing two striped shoots on one side and two unstriped shoots on the other side.

In March, 1900, Mr. S. B. Kirton, proprietor of the Arthur Seat plantation, Barbados, observed several stools of cane showing bud variation growing in the outside row of a field on his estate. From a common base sprang red striped canes on one side and pale yellow unstriped canes on the other side (Fig. 2). An examination of five clumps in which the phenomenon was noticed gave the following figures:

| *Stool* | *White canes* | *Red striped canes* |
|---|---|---|
| 1 | 6 | 6 |
| 2 | 9 | 6 |
| 3 | 6 | 4 |
| 4 | 5 | 6 |
| 5 | 1 | 16 |

The cane originally planted was determined in each case to have been Red Ribbon (Striped Cheribon, yellow and blood red color). In one clump which was examined carefully it was found that a bud of the striped cane which was planted had produced a white cane which in turn produced a ribbon cane from a bud below the surface of the ground. The white canes were identical

[6] Dr. W. Stubbs, *Sugar Cane*, 1897, p. 66.

with the Burke variety (White Cheribon, yellow-violet color).

Subsequent to these investigations Mr. James Clarke, of North Queensland, recorded the following instances of bud variation in a letter to Prof. J. B. Harrison, of the West Indian Department of Agriculture. In cutting Striped Singapore canes (Striped Cheribon) a short time previous he had noticed what appeared to be ripe, yellow Rappoe canes (Burke or White Cheribon) growing out of the middle of the Striped Singapore stools. Some stalks were found with purple stripes on a few of the lower joints, while the upper part of the stalk was of a uniform yellow color. Careful search showed that the canes planted had really been of the Striped variety. To make sure that the yellow canes growing from the center of the Striped Singapore stools were true sports, a stool of mixed canes was dug and sliced through the center. This showed that the striped canes were the parents of the yellow sports which had sprung from them.

There seems no reason to doubt that the White and Black Cheribon canes originated as variations from the Striped Cheribon, and they are repeatedly found appearing as sports of that variety. These canes have been introduced into nearly all cane-growing districts, and as sugar producers they are equal in value to the Otaheite.

It is important to note that when a striped cane throws sports two varieties arise, one light colored and one dark colored, and that almost always the light-colored and the dark-colored canes arising from any one variety are identical. Thus almost every light-colored sport from a Striped Tanna cane is a White Tanna, and nearly every dark-colored sport from a Striped Tanna is a Black Tanna.

### VARIATIONS FROM SELF-COLORED VARIETIES

Sporting from self-colored canes has been less frequently observed than from striped canes, but some self-colored canes have been known to give rise to two distinct striped bud variations. In Mauritius the Louzier (yellow color) has been known to throw two distinct sports, one a cane identical with the Mignonne (red and green striped), the parent of the Louzier, and the other the Horne (irregularly striped red, green and yellow). Mr. Deerr also observed similar sports springing from the Otaheite cane under the names of Bourbon and Lahaina in Demerara and Hawaii.

The Horne cane just mentioned is of especial interest as its appearance was one of the earliest, if not the earliest, recorded instance of a striped cane originating from a self-colored one. It was first found by Mr. J. F. Horne springing from a plant of the Louzier variety and has been grown on the plantation scale in Mauritius. A cane exactly similar to the Horne has been observed several times in Bourbon (Louzier or Otaheite) fields in Demerara.

The Green Rose Ribbon cane is a green and yellowish-pink striped variety which originated as a sport of the Otaheite or Louzier and is grown with success in Australia.

Another instance of a bud variation of this same character was observed in the Hawaiian Islands by Mr. E. W. Broadbent, who found a green and yellow ribbon cane springing from the White Tanna. In this case the sport was quite distinct from the Striped Tanna, the parent of the White Tanna.

The Cavangerie cane, one of the standard varieties of the world, is extensively cultivated in Mauritius under the name Port Mackay. It is claret colored, with an inconspicuous but clearly defined deep green stripe. In Mauritius this variety has given rise to a black cane called the Port Mackay Noir.

Among the canes introduced into Mauritius from New Caledonia was a striped one originally known as Tsimbec, which is striped red and yellow. From it several sports have arisen, one of which, yellowish-red in color, is known as Iscambine Rouge and is grown on the plantation scale.

In Hawaii a variety called the Striped Tip (dark red and pinkish-green color),

of uncertain origin, has given rise to the Yellow Tip (light green becoming yellow at maturity).

### SUMMARY

These scattering instances of bud variations may be briefly summarized as follows:

Bud variations in the sugar cane are quite common and have been recorded in Louisiana, the West Indies, Mauritius, Hawaii and Australia.

The difference between mother plants and sports is often as great as between recognized varieties.

Bud varieties have been noticed as—

1. Differently colored side shoots from one cane.

2. Differently colored canes in one stool growing from a single piece of planted cane.

3. A stalk with some joints striped and some unstriped.

4. Strains showing differences in hardiness.

5. Strains showing differences in sugar content.

Plants grown from cuttings of the bud sports tend to reproduce true to the character of the sports.

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## Better Dairying by Bull Associations—Joint Use of Good Sires Improves Herds[1]

Dairymen who would like to use pure-bred bulls to improve their herds but who cannot afford to purchase such animals should investigate the advantages of a coöperative bull association.

These organizations are formed by farmers for the joint ownership, use, and exchange of pure-bred bulls. The purchase price and cost of maintenance are distributed according to the number of cows owned by each member, thereby giving the dairyman an opportunity to build up his herd at a minimum expense. The organization also helps its members to market dairy stock and dairy products, to fight contagious diseases of cattle intelligently, and in other ways to assist in improving the dairy industry. Farmers' Bulletin 993, recently issued by the United States Department of Agriculture, gives directions for the organization and operation of bull organizations, together with constitution and by-laws necessary for such an organization.

The typical coöperative bull association, as recommended by the dairy specialists of the department, is composed of from fifteen to thirty farmers who jointly own five bulls. The territory in which these farmers live is divided into five "breeding blocks," one bull being assigned to each block.

In a survey conducted by the department on 1,219 farms in eight districts in Iowa, Minnesota, and Massachusetts, in which there were no associations, it was found that there were 817 bulls, having an average value of $76. Had the owners of these cheap bulls been properly organized, the same investment would have purchased the necessary bulls of an average value of $283. In one association having more than 100 members the original cost of good pure-bred bulls to each member was only $23. When questioned regarding the value of coöperative bull associations, 150 farmers in Maryland, Michigan and Minnesota estimated that the use of bulls belonging to the organization increased the value of the offspring in the first generation from 30% to 80%, with an average of 65%.

### SUCCESS DEMANDS CARE

The selection of the bulls for an association is one of the most important considerations. A good pure-bred bull will make rapid and marked improvement in the herds, and the association interest increases in proportion to the improvement obtained. If a poor dairy bull is used, the milk production of the members' herds is sometimes reduced, the interest is lessened, and these conditions may lead to the breaking up of the association.

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[1] Weekly News Letter, U. S. Department of Agriculture.

# NEW PILLAR ROSE

W. Van Fleet

ALMOST promising new hardy pillar or low-climbing rose of composite parentage, a result of applying pollen of a vigorous hybrid between the new Chinese *Rosa Soulieana* and *R. setigera,* the wild Michigan or Prairie rose, to the stigmas of an unusually hardy seedling of *R. Wichuraiana* that had the Tea rose Devoniensis as its pollen parent. All other seedlings of this crossing have a tinge of pink imparted by *R. setigera,* but the blooms of *W. S. 18*[1] are pure white, relieved by the prominent yellow stamens that characterize three of the four species involved in its production. The flowers are borne in graceful clusters covering the whole plant, as shown in the illustration, and are succeeded by an equal number of good-sized deep red fruits that endure with little change in coloring all winter. The blooms are over 2 inches across, of perfect form and great substance, remaining in good condition for several days and are so thickly set that the petals nearly touch over the whole surface of the foliage, which is thick, firm and of a pleasing bluish-green shade. The canes are strong, arching, with heavy side-shoots bearing the great flower clusters, and are naturally so well arranged that little support or pruning appears to be needed. The plant proved entirely hardy during the past test winter that killed many supposedly hardy roses to the snow line.

The season of bloom at Washington is early June, and there is considerable fragrance of the character usually associated with the musk rose, to which *Rosa Soulieana* belongs. *W. S. 18* has not yet reached its full development and will probably grow 10 or more feet higher in favorable situations, and doubtless will find its greatest utility as a specimen tall bush or pillar rose, in open situations rather than as a porch climber. It is hardy and vigorous and appears resistant to all foliage and cane diseases that affect roses in this climate.

*Rosa Soulieana* was discovered about 1895 by the French explorer Pere Soulie growing in fair abundance along the upper reaches of the Yalung River in Southwest China and was soon after established in England, where it is regarded as perfectly hardy and grows in the open perhaps more vigorously than any other rose species. It was brought to this country in 1909 by the Office of Foreign Seed and Plant Introduction, and has turned out to be only doubtfully hardy about Washington, but otherwise well worth growing as an oriental wild rose. It is very floriferous when not too severely injured by winter, the creamy-white flowers, an inch or more across, being disposed in dense terminal corymbs, while the buds are pale yellow just before expanding. The strong canes grow 7 or 8 feet high in a season, and the abundant bluish-green foliage appears rarely troubled by insects or disease. The tendency to kill back in winter, however, has made it desirable to interbreed this interesting newcomer with other rose species and varieties of undoubted hardiness, and *W. S. 18* is at this time the most promising outcome, though many attractive seedlings, some of dwarf growth with double blush and white blooms borne throughout the growing season, have been secured. *Rosa Soulieana,* blended with desirable hardy rose species and varieties, appears likely to prove a valuable acquisition to the equipment of the breeder of garden roses.

In *W. S. 18, Rosa setigera* appears only to have contributed hardiness, *R. Soulieana* habit, foliage and abundance of bloom, while *R. Wichuraiana* and Devoniensis (*R. odorata*) size, substance and finish of the individual flowers.

[1] *Rosa Soulieana* × *W. S. 18*, Raised Bell Experiment Plot, Glendale, Maryland, 1915.

**ROSE SEEDLING W. S. 18**

*Rosa soulieana* x *R. setigera* ♁ × *R. wichuraiana* x *R. odorata* ♂. Blooming twig about two-thirds natural size. Photographed by Dr. W. Van Fleet at Bell, Md., June 12, 1918. (Fig. 18.)

**ROSE SEEDLING W. S. 18**

*Rosa soulieana* x *R. setigera* ♁ × *R. wichuraiana* x *R. odorata* ♂. Raised at Bell, Md. Plant three years from seed. Photographed by Dr. W. Van Fleet at Bell, Maryland, June 12, 1918. (Fig. 19.)

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## Pure-Bred Pigs "Preferred Stock"

More than 80,000 boys and girls in the United States are enrolled in pig clubs organized and conducted by the United States Department of Agriculture and the state agricultural colleges, and 71% of the reporting members raise pure-bred pigs. The juvenile wisdom displayed is supported by records showing that more than 12,000 pigs made an average daily gain of 1.14 pounds in weight, which is considerably above results obtained on most farms. Pig clubs, now established in twenty-eight states, are believed to have such a beneficial effect on the swine industry of the country that the Department of Agriculture has assigned forty-nine specialists to foster their further development.—*Weekly News Letter, U. S. Dept. of Agriculture.*

# BIOLOGY AND POLITICS

WALTER SONNEBERG

THE danger in applying knowledge gained in one department of life to other and quite distinct departments lies in the tendency to ignore limitations of application. If we are going to apply principles formulated for biology to political conditions we want to be pretty sure in advance just what the limitations of those principles are. Alleyne Ireland[1] suggests the enforcement of a biological teaching to combat the growing worship of the "blind god of Numbers." Granting the impendment of catastrophe in the commitment of political power to the hands of proletariat, Germany's experience of biological principle does not furnish much encouragement for further application. It is now apparent that a biologically buttressed formula was the most potent inciter to Hun frightfulness.

Through the persuasion of Haeckel and his mechanistic logic, the doctrine "might makes right" was consolidated and confirmed in the German mind: through the idealization of man the machine Germany went down to civilization-crushing defeat—imagine the moral effect, on receptive minds, of the preachment that all life rose exclusively and strictly from mechanic stresses and chemical reactions. Earlier philosophers emphasized the advantages of a God relegated to the remoteness of ultra-astronomical confines; subsequent developments made manifest that the spiritual beauty they painted was a mirage veiling lust released and rapacity revivified. Discontented minds the world over eagerly devoured the alluring doctrine. What could be more palatable to their half enlightened mentality than a philosophy made up of egotism and irresponsibility compounded in a spiritual vacuum?

Mr. Ireland mentions the tendency of talent to concentrate hereditarily through selective mating; the advertisement and acceptance of this tendency is the only hope for rescuing the political hierarchy from the maw of Bolsheviki. Though we may be loath to admit it, the smoothness of our government operation is the outcome of the political wisdom of the self-selected few who control electorate votes. Where political power happens to foregather in fairly wise hands results are fairly satisfactory; where it is unwisely used democracy is less triumphant.

One thing is certain, neither biological nor political science has anything to gain by adherence to a scientifically repudiated mechanistic doctrine. Biologically it has served its purpose in stimulating research; politically it has proven criminally defective. In the hands of ignorance it undeniably furthers irresponsibility and immorality, notwithstanding naive protests of closest biologists.

As Dr. Frederick Adams Woods indicates,[2] it may be possible to eliminate despotic rulers by regulating the sources from which they spring, but a proletariat gone rabid, of misinformation and impracticable ideals cannot be disposed of so summarily. No satisfactorily permanent substitute for common sense has yet been found. Biology is under the strongest obligation to unteach what it has already taught, and leave politics to work out its own salvation. While agreeing with Mr. Ireland as to the unfitness of majority to vote intelligently on complicated political measures it is less easy to accept his remedy.

The glaring disparity between moral profession and performance in the modern world is its great defect. The remedy lies, not in formal education, not in biological formula; but in the steady and consistent example of work and sacrifice set by the knowing few for the unknowing many. Convert the energy of laudation and oratory into useful, character producing work. Nothing less will avail to stay the forces of license and licentiousness let loose by a mistaken application of biological doctrine.

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[1] JOURNAL OF HEREDITY, December, 1918, p. 339.
[2] JOURNAL OF HEREDITY, December, 1918, p. 353.

**MOTHER, TWO GRANDMOTHERS, AND FOUR GREAT-GRANDMOTHERS**

Josephine Preston, of Denver, Colorado, three months old (when the photograph was taken), has the rare distinction of possessing two grandmothers and four great-grandmothers, all living. (Fig. 20.)

# THE INCREASE, DIFFUSION, AND DECLINE OF THE MAYFLOWER AND OTHER NEW ENGLAND STOCK

**Present Number of Living Mayflower Descendants Estimated at 85,000.**

J. GARDNER BARTLETT
*New England Historic Genealogical Society*
*Boston, Mass.*

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THE article in last November's number of this magazine by S. J. Holmes and C. M. Doud entitled "The Approaching Extinction of the Mayflower Descendants" has aroused wide interest. While the falling birth rate during the last seventy-five years among the New England stock has been deplorable, the present conditions are not quite so desperate as pictured by Messrs. Holmes and Doud, as their conclusions were based on far too small a field of data.

The early history of New England, the genealogies of its families, the increase and diffusion of the stock throughout the whole country, the decline in its birth rate during the last two generations, and the amount and effect of foreign immigration since 1845 have been subjects of much interest to the writer for twenty years.

About 25,000 English colonists settled New England between 1620 and 1643 (over 20,000 coming between 1630 and 1640), after which general immigration ceased until after 1790, except for about 8,000 Scotch-Irish immigrants who came here between 1715 and 1750. The total population of New England in 1650 was about 33,000. Colonial censuses and study of vital records in thousands of families in New England genealogies establish that this old stock doubled in population about every 28 years, which give the following data on

*Population of New England Stock*

| | |
|---|---|
| 1650 | 33,000 |
| 1678 | 66,000 |
| 1706 | 132,000 |
| 1734 | 275,000 |
| 1762 | 560,000 |
| 1790 | 1,125,000 |

(The Scotch-Irish immigration, 1715–1750, is the cause of a little more than doubling in the figures of 1734 and 1762.)

According to the United States Census of 1790, the population of New England was 1,009,000; but at that time at least 115,000 persons of New England origin were living outside New England, mainly in New York, New Jersey and Pennsylvania. So of the nearly 4,000,000 total population of the United States in 1790, about 1,125,000, or about 28%, were of the old New England stock, which continued to double about every twenty-eight years until about 1845. Its birth rate then commenced to fall, so about forty years elapsed before the population of this stock had again doubled about 1885; and since then a further fall in birth rate has resulted in thirty-four years in an increase of hardly 25% in this stock in 1919 over what it was in 1885.

United States Censuses, immigration statistics, and the preceding figures on New England stock, show how the latter has steadily decreased in its percentage in the total population of the country since 1790.

| *Year* | *Total Pop.* | *N. E. Stock* | *P. C.* |
|---|---|---|---|
| 1790..... | 4,000,000 | 1,125,000 | 28 |
| 1818..... | 9,000,000 | 2,250,000 | 25 |
| 1845..... | 20,000,000 | 4,500,000 | 22½ |
| 1885..... | 55,000,000 | 9,000,000 | 16 |
| 1919..... | 106,000,000 | 11,000,000 | 10½ |

*Immigration to the United States*

| | |
|---|---|
| 1790–1818 (estimated)..... | 250,000[1] |
| 1818–1845..... | 1,000,000 |
| 1845–1885..... | 11,000,000 |
| 1885–1919..... | 21,000,000 |

From 1650 to 1845 when the New England stock doubled by reproduction about every twenty-eight years, the vital records of over 10,000 separate families taken from 100 genealogies of New England families show an average of nearly eight children per marriage, of whom an average of nearly two died in infancy or unmarried, the infant mortality being rather high.

An examination of 9,000 completed families in twenty genealogies of New England stock where the parents married between 1880 and 1910 shows an average of 2.92 children per family. About 6,000 of these marriages between 1880 and 1900 had an average 3.15 children; and about 3,000 marriages between 1900 and 1910 had an average of 2.71 children. These 9,000 families were not picked or selected, but embraced all degrees, wealthy and poor, cultured and uncultured, of many kinds of occupations or professions, and with residences on farms, in small towns and in great cities located all over the United States. This wider scope of data results in much higher figures of fertility than Messrs. Holmes and Doud secured from their note of only seventy-three marriages since 1880 which gave but 2.04 children per marriage; and their data of only 1.5 children per marriage from their twenty marriages since 1900, is certainly far too low for a general average of the whole stock throughout the country, which doubtless still continues at over 2.5 children per marriage.

According to my observation and compilations, the United States is not as ready a melting-pot of races as popularly supposed. The old New England stock, now spread all over the country, still continues remarkably pure, as its members still marry principally among themselves, and if not, then generally with British stock of English, Scotch, Scotch-Irish, or Welsh descent, or with the descendants of the old New York Dutch; marriages with persons of Irish, German, Slavic, or Latin descent are infrequent.

The "Mayflower Descendants" have naturally experienced increase, diffusion and recent decline in fertility similar to that of the rest of the New England stock. By exceptional temporary fertility, the 101 passengers of the "Mayflower," although fifty died within a few months, increased from 1620 to 1650 to at least 270 souls living in the latter year who can be named. Using the previously quoted proportions of increase, the following results appear:

| *Year* | *Living Mayflower descendants* |
|---|---|
| 1650..... | 270 |
| 1678..... | 540 |
| 1706..... | 1,080 |
| 1734..... | 2,160 |
| 1762..... | 4,320 |
| 1790..... | 8,640 |
| 1818..... | 17,280 |
| 1845..... | 34,560 |
| 1885..... | 69,120 |
| 1919..... | 85,000 |

An average birth rate as low as 2.50 children per family can doubtless sustain the Mayflower stock to its present strength of 85,000; so the apparent present rate of about 2.71 is encouraging against its "extinction." The same birth rate of 2.50 will also maintain at its present numbers the 11,000,000 of the rest of the old New England stock, now spread all over the country although its percentage in the total population will decrease below the present 10.5 per cent, owing to past and future immigration of foreigners of higher fecundity.

[1] The 80,000 population acquired by the Louisiana Purchase in 1803 is included in this estimate.

# VARIATION, SELECTION AND MUTATION IN ONE OF THE PROTOZOA

THERE is a theory that the one-celled organisms dividing as they do by simple fission ought to be all alike in their heredity substances, in other words that the genotype should be constant, and selection should be of no avail. The recent work of Middleton and Jennings has brought this theory into question and still more recently (1918) R. W. Hegner has made a contribution to this fundamental biological problem. In his investigation Professor Hegner used one of the lowest and simplest of animals but one that fortunately has a variable characteristic that readily lends itself to accurate observation, namely the number of spines on its shell. His conclusions and proofs are clearly given in Volume 4 of the Proceedings of the National Academy of Sciences. In summarized form they are as follows:

*Arcella dentata* is a microscopic protozoon belonging to the lowest class, the Rhizopoda. It is as simple as any animal organism it is possible to obtain that has measurable characteristics. It varies in diameter from 73 microns to 150 microns and in spine number from 7 to 20. It multiplies vegetatively and rapidly and the characteristics of the shell are not modified by growth or by the environment, and are heritable but variable. Can heritably diverse lines with respect to spine number and diameter of shell be distinguished among the descendants of a simgle specimen of *Arcella dentata* produced by simple fission?

Small families were reared from 70 "wild" specimens selected so as to include large, small, and medium sized organisms. Seven hundred and forty-six specimens were obtained in this way, ranging in number from only 2 or 3 to 149 per family. The mean spine number of the families ranged from 10.40 to 14.07. Variations in spine number occurred among the descendants of single specimens during fission and these variations were in part inherited. It was found that the hereditary constitution of the different families was different with respect to spine number and the conclusion was reached that a "wild" population consists of a large number of heritably diverse families so far as spine number is concerned, and also probably as regards diameter, since spine number and diameter are closely correlated.

The main problem was next undertaken, *i. e.*, an attempt was made to isolate heritably diverse lines from among the descendants of a single specimen produced by vegetative reproduction.

The data prove that the descendants of a single specimen of *Arcella dentata* produced by vegetative reproduction differ slightly from one another in their hereditary constitution and that heritably diverse lines may be isolated from among them, differing both in spine number and in diameter, and that these two characters are closely correlated. These heritably diverse lines resemble certain of the families that were reared from "wild" specimens, and suggest that differences in the hereditary constitution of these wild specimens may have originated in the same way.

The general conclusion reached is that within a large family of *Arcella dentata* produced by vegetative reproduction from a single specimen, there are many heritably diverse branches. These diversities are due both to very slight variations and to sudden large variations ("mutations"). The formation of such hereditarily diverse branches appears to be a true case of evolution that has been observed in the laboratory and that occurs in a similar way in nature.

# APPLIED EUGENICS

By

CAPTAIN PAUL POPENOE, U. S. A.

*Former Editor of the Journal of Heredity (Organ of the American Genetic Association), Washington, D. C.*

and

ROSWELL HILL JOHNSON

*Professor in the University of Pittsburgh*

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"The results of all the trustworthy observations and experiments have been taken into account . . . This book should command the attention not only of students of sociology, but, as well, of philanthropists, social workers, settlement wardens, doctors, clergymen, educators, editors, publicists, Y. M. C. A. secretaries and industrial engineers. It ought to lie at the elbow of law-makers, statesmen, poor relief officials, immigration inspectors, judges of juvenile courts, probation officers, members of state boards of control and heads of charitable and correctional institutions. Finally, the thoughtful ought to find in it guidance in their problem of mating. It will inspire the superior to rise above certain worldly ideals of life and to aim at the family success rather than an individual success.—*From the introduction by Edward Alsworth Ross, Professor of Sociology in the University of Wisconsin.*

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*Price*, $2.10

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